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RELATION OF THUMB-SUCKING TO MALOCCLUSION

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BEFORE entering into the technical phases of this subject, it seems advisable to call attention to some general facts concerning the habit of thumb-sucking. The first of these is that despite the many years which have been given to study of the etiology of the habit but little prevention has resulted. About two million children are born annually in the United States. It is well known that a large proportion of them form the habit during infancy. Most of these persist into early childhood, and some even into maturity. That situation will continue for many years, with lessening numbers, it is hoped, through better understanding of the etiology of these habits. The recent research of Levy, of the New York Child Guidance Association, in that field seems outstanding in practical value.

At present, consideration must be given mainly to correction of the already established habits. There is now difference of professional opinion as to whether these habits are of sufficient importance to justify widespread home and office treatment to cure them. As a result of this difference of opinion, the laity and those who are concerned with the care of children are in a quandary. Orthodontists have in their files the necessary evidence to arrive at the truth. They are the ones most competent to interpret it correctly.

In the hope that it will add to the necessary information concerning the subject, I shall present a partial report of observations made during treatment to cure thumb- and finger-sucking habits for 38 children. These are not selected cases. They constitute all the cases in which the habit was being actively performed that came into my practice during the years 1934 to 1936 inclusive.

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The study was begun in 1934, because early in that year I first used a type of appliance in the mouth that proved to be unusually efficient in breaking the habit. As such favorable changes were soon noted in the child, I decided to keep adequate records of all subsequent cases. Accordingly, case histories were secured, plaster models and photographs made, treatment records kept, and a check-up system has been maintained to date.

The records show that in all instances the habits were well established before one year of age; that in a large majority they began before the children were six months old and that in three cases the habits were noted before the mothers left the hospital.

SURVEY OF MALOCCLUSION

Table I is a tabulation of the main features of malocclusion found in these cases. Column 1 shows that the ages ranged from three to fourteen years, while Column 2 holds the number of cases in each age group. Eleven of the dentures were deciduous, 26 were mixed, and in one all the teeth were of the permanent set.

TABLE I

GENERAL SURVEY OF 38 CASES OF MALOCCLUSION

AGE	NO. OF CASES	MAXILLARY PROTRUSION	MANDIBULAR RETRUSION	OPEN-BITE	SHORT BITE	EXCESSIVE OVERBITE	MOLAR LINGUOCCLUSION	NARROW MAXILLARY ARCH	MOUTH BREATHING	CLASS I	CLASS II DIVISION I	CLASS II DIVISION I SUBDIVISION
3	5	4	2	1	2	2	1 R	5	4	2	2	1
4	2	2	1	1	1			2	1	1		1
5	3	3		2	1			2	3	2		1
6	2	1	1		2			1	2	1	1	
7	8	6	2	6	2		1 R & L	6	4	6		2
8	12	12	6	11	1		2 R	9	9	8		4
9	2	2	1		1	1		2	1	1		1
10	2	2		1	1			2	2		1	1
11	1	1	1	1				1	1			1
14	1	1	1	1				1		1		
Total	38	34	15	24	11	3	4	31	27	22	4	12
Per cent		89.4	39.4	63.2	28.9	7.8	10.5	81.5	71	57.8	10.5	31.5

It may occasion surprise to see the number of instances in which the habit had persisted beyond early childhood. From long study of the habit, I am convinced that a great many more of these habits persist longer than is generally believed. While the act is not performed with the same vigor by some of the older children, it is often carried on with less frequent indulgence at night and during fatigue or mental irritation. Doubtless many of the protrusion cases that we ascribe to mouth breathing alone are really maintained in part by such occasional practice.

This tabulation revealed a number of facts of especial significance to orthodontists. (1) All the children were practicing the habits when the models were made, and had been since infancy. (2) All the cases were in malocclusion. In 32 it was pronounced. (3) Most of the regional and general types of maloc-

clusion were well represented in the group. (4) Two important types were conspicuous by their absence. There was not even a tendency toward Class III in any of the cases. Excessive overbite, a type usually very prevalent in children of these ages, was present in only 3 cases, or 7.8 per cent of the total number. (5) There were extraordinarily high percentages of certain types. These were maxillary incisor protrusion, 89.4 per cent; mandibular incisor retrusion, 39.4 per cent; open-bite, 63.2 per cent, short bite, 28.9 per cent; narrow arch, 81.5 per cent and Class II Division 1 Subdivision, 31.5 per cent. (6) Both the regional and the general types of malocclusion as seen in the chart were found fully established and equally prevalent among younger and older children. (7) There were 22 instances of Class I, 4 were Class II Division 1, and the surprisingly large number of 12 in Class II Division 1 Subdivision. (8) In 27 instances, or 71 per cent, there was mouth breathing during all or part of the time. It did not always accompany protrusion. (9) The high percentages and the physical similarity of cases in the certain types named in (5) indicated that they owed their origins in large measure to causes common to all and that these causes were definite in nature, such as habitual, extrinsic mechanical forces would be. It seemed unlikely that such uniformity of abnormal patterns would obtain with such extraordinary frequency if they were due to perversion of general growth from constitutional causes.

While considering the effects of thumb-sucking in these cases the ever present biological background must always be kept in mind. Its influences were basic in these as in all other cases. That this aspect of etiology will not be dealt with further at this time is not because it should be minimized but because it seems best in this report to clear the field of the indeterminate and to point out the correlation found between the malocclusion present and the purely mechanical forces of the habit.

ABNORMAL FORCES OF THE HABIT

In order to evaluate the forces exerted, close study was given to the individual habits of all the children in the group. Much variety was seen in the methods used, in the time spent on the habits and the vigor with which they were practiced. Three major mechanical forces were noted. Any one of these seemed capable of inhibiting or diverting the course of normal bone growth. These forces may be enumerated and described as follows, although not in the order of their importance as factors in the cause of malocclusion:

1. *The Passive Force of the Digit Between the Arches.*—This force is the one generally regarded as the cause of malocclusions accompanying the habit. As already seen, in this group of cases, it was associated with 89.4 per cent of protrusion, 39.4 per cent of retrusion, 63.2 per cent of open-bite, and 28.9 per cent of short bite. The digit usually acted merely as an obstruction to orderly eruption. The protrusion and retrusion influenced by it consisted of simple labial or lingual tipping of the incisors from correct vertical position. The apices remained within the normal apical bases, and there was little bone distortion. Extrusion of the teeth through the gum was not prevented. The open-bite was influenced through the force inhibiting the normal vertical growth of the sup-

porting bone. This arrest of vertical development was invariably greatest in the maxillary bone. In three cases, two or three fingers of one hand were held between the buccal as well as the anterior segments of the arches. No interference with vertical growth could be detected.

In some of the cases, this force seemed solely responsible for causing and maintaining these anterior malocclusions. In these instances, self-correction resulted after the habits were stopped, regardless of the ages of the patients. In the majority of cases, this force acted in conjunction with other forces of the habit or with secondary habits of the tongue and lips and of mouth breathing. Self-correction did not result in these from correcting the thumb-sucking alone.

2. *Abnormal Pressure of the Cheeks.*—The degree of muscular contraction of the cheeks during thumb-sucking varied greatly among these children. In some instances, the muscles of the lips and cheeks were kept tense against the arches, while in others such contraction was scarcely noticeable. The degree of contraction depended upon the position in which the digit was held. If well back in the palate, the pressure was comparatively strong, but if in the anterior part of the arch it was slight. It was found that the abnormal actions of the cheeks and tongue during practice of the habit were very different from the helpful ones of normal nursing. The tongue was drawn tightly around the digit and produced little outward force against the arch, while the cheeks pressed inward. In normal nursing there is little inward cheek pressure, while the tongue occupies the entire palate and exerts a strong expansive force.

The models showed that one type of malocclusion, prevalent in these cases, corresponded to this inward pressure upon the buccal segments. In 81.5 per cent there was less than normal width of the arches, particularly the maxillary ones. This deficiency was greatest in the cuspid regions where the force was most potent. The presence or absence of the condition was generally in accord with the presence or absence of abnormal cheek pressure.

3. *Muscular Pressure of the Digit Against the Palate.*—In 18 of these children it was found that during the practice of the habit a pressure was maintained by the thumb or finger upon the hard palate. In all but 2 of the 18, the pressure was accessory to the sucking. In those 2, the thumbs were not sucked at all, satisfaction seeming to be gained through this pressure against the soft tissues.

Except in these 2 latter cases, it was found that the existence of this accessory force depended upon the method of the particular habit. If a thumb or finger was held in the center of the palate, it was not usually present. The reason apparently was that when the thumb was centrally placed, the weight of the arm rested against the chest and sucking could be carried on comfortably without strain upon the muscles of the arm. If the digit was held on one side of the palate, pressure was always exerted. When so held, the palm of the hand was turned obliquely upward so that the ball of the thumb could rest partially upon the anterior portion of the lateral incline of the palate. This necessitated twisting the arm and holding it away from bodily support which caused fatigue in the hand and arm while the thumb was being sucked. A counter pressure of the digit against the palate was necessary to steady the hand and relieve this

fatigue. It always was placed high on the anterior incline of the palate to provide a good grip. When laterally placed, the thumb of the same side was used.

There was no muscular pressure when the fingers were employed with the palm of the hand downward. The fingers would bend and the arm rested upon the chest. If a finger was sucked with the palm of the hand turned upward or mesially, the hand and arm were held in the uncomfortable positions described, and muscular pressure against the palate was present.

This force was found to be very damaging to occlusion. Whenever it had been present, there was invariably malocclusion in other parts of the mouth in addition to the anterior malformations. It was associated with major distortions in growth of the maxillary bone, with malocclusion as one of the consequences. These gross structural deformities were present in some of the youngest children observed.

MAXILLARY PROTRUSION

Two general types of protrusion caused by these habits were noted. One consisted of simple labial tipping of the anterior maxillary teeth. The other

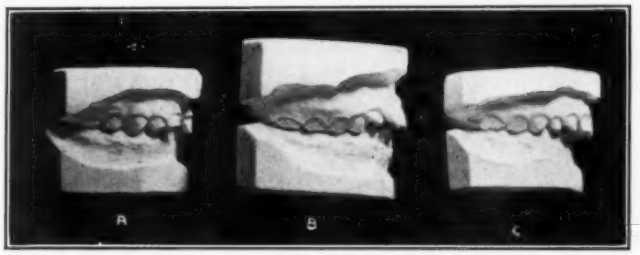

Fig. 1.—Protrusion in deciduous dentures caused by thumb-sucking. *A* and *B*, simple forward tipping of maxillary incisors; *C*, much overdevelopment of the premaxillary bone by forward thumb pressure.

involved extraordinary forward development of the premaxillary bone, the teeth being thereby carried forward bodily into protrusion.

Fig. 1 shows comparatively early stages of these conditions. All are Class I cases. In *A* the simple type of forward incisor tipping is shown. Prognosis was good, as it regarded the anterior malocclusion, if the habit was broken early, because only the thumb acting through Force 1 was causing it. Due to the closeness of the bite, the tongue could not well rest habitually between the arches and force these teeth into greater protrusion. As to normal lateral development, prognosis was not favorable. The formation of the arches was too narrow. In this case abnormal muscular pressure of the cheeks, Force 2, was present during practice of the habit. In *B* in addition to the protrusion the bite was open. The tongue in performing its functions habitually passed into the space between the arches, and thus it aided in increasing and maintaining both the protrusion and the open-bite. Mouth breathing had been set up in turn. Either or both of these follow-up habits would have interfered with self-correction after the thumb-sucking had ceased. The arches were of normal width. The thumb was held in anterior position in the palate and there was no cheek pressure. *C* shows the second type of protrusion. The bone carrying the

anterior teeth had been much overdeveloped. Strong muscular pressure (Force 3) exerted in a forward direction against the anterior incline of the palate was associated with the protrusion. The force used by the child was so noticeable that the mother called attention to it, as she sensed the potentiality for damage by such a strong pressure habitually exerted against the tissues. Already at three years of age, the premaxillary bone and the upper lip had been forced abnormally far forward and there was much facial disharmony. Mouth breathing had been induced. The depth of the bite may have prevented the tongue from being thrust in between the arches during deglutition, but the lower lip would have been held under the maxillary incisors. That would have increased the protrusion. Vigorous muscular contraction in the anterior parts of the cheeks was associated with much lack of expansion in the adjacent regions of the maxillary arch. Self-correction seemed impossible.

SECONDARY HABITS

Fig. 2 illustrates the additional effects of the secondary habits of thumb-sucking, viz., those of the tongue, and lip and mouth breathing. In *A* there

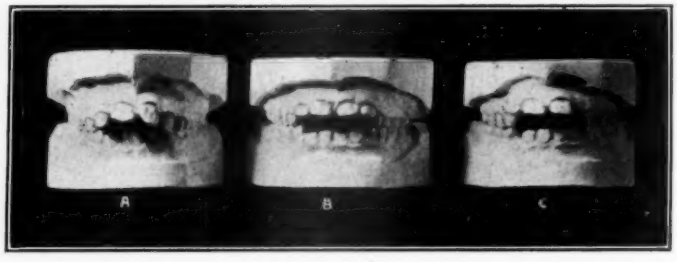

Fig. 2.—Three exaggerated cases in which secondary habits have been set up by thumb-sucking: *A*, abnormal tongue habit and sucking of the lower lip; *B* and *C*, abnormal tongue habits and mouth-breathing.

was normal breathing, as the lower lip was habitually sucked and this plugged up the space between the arches. It prevented ingress of air during breathing, but it greatly exaggerated the protrusion of the maxillary incisors and retrusion of the mandibular ones. In *B* the opening made by the thumb between the maxillary and mandibular teeth had allowed the tongue to rest habitually between the arches. It affected adversely all the incisors, which the thumb did not do originally. In *C* the tongue and lower lip were both adjuncts to the thumb-sucking, and mouth breathing was in full sway.

It is improbable that the abnormal tongue and breathing habits in *B* and *C* would have ceased spontaneously, and the conditions would have remained after the thumb-sucking habits had ceased except for orthodontic treatment. Case *A* was more favorable as both thumb and lip habits may have been automatically corrected and the malocclusion much improved.

These pernicious accessory habits do not usually accompany thumb-sucking in deciduous cases, but are found in most instances after the permanent incisors are erupted. This probably explains the findings of Lewis that these anterior malocclusions usually tend toward self-correction if the habit is broken by the time the child is five years of age.

OPEN-BITE

The most prevalent effect of the habit found was inhibition of downward growth of the maxillary incisors. In all cases in which the child had the characteristic method of holding one digit in the palate, it was universal. As seen in Table I, 63.2 per cent were judged to have open-bite and 28.9 per cent to have abnormally short bite, together constituting 92 per cent of the total.

Although protrusion usually accompanied open-bite, there were four instances in the group in which it did not. Fig. 3, case *A* presents one of these open-bite conditions that any orthodontist would consider to be serious. Evidently the finger originally prevented vertical incisal development and the tongue aided in exaggerating the space between the arches. The habit was formed in the first month of life and much time had been given to its indulgence. In *B*, in addition to the finger and tongue causing open-bite, there was bilateral lingual occlusion of the maxillary buccal teeth. In this case, the middle finger was sucked and the index and third fingers were pressed on the outside of the cheeks over these teeth. The mechanics of the cause is apparent and the effects

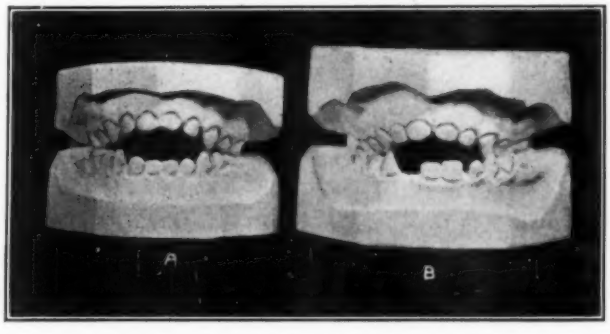

Fig. 3.—Types of open-bite caused by thumb-sucking: *A*, by the thumb and secondary tongue habit; *B*, by sucking of the middle finger and pressure of the index and third fingers on the buccal segments of the maxillary arch, and secondary tongue habit.

are understandable when it is considered that it was operating during infancy and early childhood. Evidently self-correction of this malocclusion was hopeless from the time the deciduous arches were formed. This is true also of case *A*, as the child was only four years old when the models were made.

Those who have had experience with cases of these types can visualize the outcome of them if they had received no orthodontic aid. Case *A* probably would have resulted in one of those extensive open-bites in which only the posterior teeth would have occluded. In case *B* the bilateral linguoclusion probably would have kept the maxillary arch much too narrow and there would have been protrusion and jumbling of the incisors with open-bite and probably mouth breathing. Viewed in maturity, with the habits long forgotten, rickets, endocrine imbalance or some other mysterious malady may have been blamed. Evidently they were not involved, as the open-bite closed in both cases when the thumb and tongue habits were corrected. Case *B*, with orthodontic expansion to size of the maxillary arch, in addition, resulted in normal occlusion which did not need mechanical retention. In analyzing exaggerated forms of adult malocclusion, it is often possible to follow this course backward through a

series of causes and to discover these habits as the original ones although they have ceased operating long before.

Straight open-bite and open-bite with protrusion are numerous in adult dentures. There were 24 instances of open-bite in this small group of 38 cases. In several more of them it was as extensive as these illustrations show. Conservatively stated, thumb-sucking is a prime factor in the cause of many of these unsightly and inconvenient malocclusions of adult life. Cases of open-bite in childhood are rare, unless they have been associated with the habit. If, by combating this habit, the number of this one type of malocclusion alone could be materially reduced, it would seem a worthwhile preventive measure. Once established, these conditions are extremely difficult to handle. Hellman has shown that even with skillful orthodontic treatment, he was successful in correcting only 16 per cent of such cases.

Fig. 4.—Front, side and occlusal views of extreme malocclusion associated with thumb-sucking. Maxillary arch exceptionally narrow. Protrusion. Open-bite. Lack of downward growth in the palate.

NARROW ARCH

Fig. 4 shows front, side, and occlusal views of a case in an extreme state of malocclusion. Mutilated by premature extraction it was impossible to classify it certainly, but it was designated as Class I. In this instance, the habit was especially pernicious and had been practiced both day and night since infancy. The thumb was held high in the center of the palate, and a strong upward pressure was maintained, while the cheeks were tensed during suction. Thus all three forces of the habit were operative. As seen by the models, the malocclusion of the teeth and the distortion of the hard structures are as might be expected when such forces were exerted during the early growth years. With the thumb exerting upward pressure and the second phalanx held between the incisal segments of the arches the effect would be to inhibit downward growth of the maxillary incisors, but not to tip them anteriorly. With the force directed away from the mandibular incisors there would be little obstruction to normal

eruption of these teeth. The unusual tensing of the cheeks during suction would tend to inhibit the inherent lateral growth of the arches as seen. It is logical to expect also that the habitual upward pressure of the thumb against the center of the palate would inhibit normal downward growth at the site. As may be noted, the models show such a condition. The depth of the depression in the center of the palate was equal to the thickness of the thumb. Its lateral walls accurately fitted the thumb, and its curved bottom was an imprint of the volar surface. Improbability of self-correction is evident. This positive example is shown as a reminder that there may be many other cases in which the indications are not so strong but whose etiology may be the same.

Narrowness of arch form is probably the most prevalent general type of malocclusion. Its cause may be briefly defined as whatever interferes with the unknown process of inherent growth, which, undisturbed, tends to typal form and size. Biologic research shows conclusively that this intrinsic process can be inhibited by malnutrition, endocrine imbalance, disease, etc. It has also been proved as conclusively that it can be inhibited, or diverted, by mechanical means, as shown by the practices of the Flathead Indians and the Chinese in preventing growth in the head and feet through providing mechanical obstruction to the inherent processes.

It did not seem reasonable to believe that the very prevalent deficiency of lateral growth found in these cases was due solely to constitutional causes. In most of them the lack of normal arch width was accompanied by growth in the same bone that was normal vertically and excessive in the anterior direction. It was noteworthy that whenever the abnormal force of the habit acted in harmony with the inherent plan of growth, there was no apparent lack of development in the region affected. On the other hand, if the habit forces were in opposition, there was always less than normal growth of the part.

The common clinical observation that maxillary second and third molars often erupt in correct lateral positions in arches that show lack of width anterior to them, seems to support the belief that this deficiency of regional growth in these cases may be influenced by external obstruction. Because of their location, those molars are not so subject to such forces as those teeth which are anterior.

As seen in Table I, this condition of narrow arch was as common among the very young children as in the older ones. If these muscular pressures of the cheek were contributing causes, it seems evident that the arch forms were influenced when the deciduous teeth were erupting, or before. Complete self-correction of this phase of malocclusion was highly improbable even if the habits had been broken as early as three years of age. Despite evidence to the contrary in some cases, the rule is that lack of lateral growth in early childhood is not entirely overcome during the later years.

CLASS II DIVISION 1 SUBDIVISION

The most outstanding and surprising feature that appeared on tabulation of the malocclusions in this group of thumb-sucking children was the extraordinarily high percentage of Class II Division 1 Subdivision cases. There were

12, or 31.5 per cent of the total number. In 6 of the 12, mesiodistal malrelation of the buccal teeth was complete. In the others the entire buccal malrelation was present but it was not complete. Such incomplete cases are often called Class I

TABLE II

CLASS II DIVISION 1 SUBDIVISION MALOCCLUSION

12 CASES (31.5% OF TOTAL)

AGE	SIDE OF MALOCCLUSION	THUMB OR FINGER USED	SIDE OF PALATAL DISTORTION	MANDIBULAR RETRUSION
11	right	right	right	very little
10	left	left	left	0
9	right	right	right	0
8	left	left	left	0
8	right	right	right	0
8	right	right	right	0
8	right	right	right	0
7	right	right	right	0
7	right	right	right	very little
5	right	right	right	0
4	left	left	left	0
3	right	left	left	0
	9 right 3 left	8 right 4 left	8 right 4 left	

with Class II tendencies. Accurately classified, they are Class II malocclusions of lesser degree. Using only the 6 cases in which the mesiodistal malrelation was so complete that no two investigators could differ as to their class, the percentage was still 15.8. Angle, in examination of several thousand cases of malocclusion, found the percentage of this type to be only 3.4. I examined 400 models as they came in rotation in a cabinet. They were appraised in 10 groups of 40 each. The highest number found in any group was 2, and in 4 of the groups there were none.

Further study of the records and models revealed the data shown in Table II. It is seen in Column 1 that in 9 of this type of case the mesiodistal malrelation was on the right side and in only 3 on the left. The case records showed that 8 of these children used the right hand in the habit and only 4 used the left, as presented in Column 2. In all of them muscular pressure was exerted in addition to the sucking. This was shown by a depression in the palate of each one where the pressure had been exerted. These depressions were in the upper portion of the anterior incline of the palate to either the right or the left of the median line. Their forms and locations showed that the force was exerted in the anterior direction. They are listed right or left in Column 3.

Column 4 presents corroborative evidence that muscular force was used and directed anteriorly. In but 2 instances was there retrusion of the mandibular incisors and then very slight. That is as it should be, as there is no lingual pressure on these teeth when force is anteriorly directed against the palate while the thumb is sucked. This lack of mandibular retrusion in these subdivision cases is significant. In contrast with this lack of mandibular retrusion in this class of malocclusion, there were 11 instances of marked protrusion among the 22 Class I cases.

In carrying each case across all four columns, a most suggestive relation of conditions appears. In all but the case at the bottom, the side of thumb, the side of palatal distortion, and the lack of retrusion were in complete agreement with the side in malocclusion. In that one case, the hand, the palatal depression, and the lack of retrusion agreed but the malocclusion was on the opposite side of the mouth. As will be seen in Fig. 5, however, it was not really an exception. Instead, because of its different nature, it furnished particularly convincing evidence in support of the unvarying rule, seen in the other cases, viz., that *the overdeveloped and distorted bone was found in exact relationship with the muscular force of the thumb.*

Fig. 5.—Exceptional case in which the mesial occlusion was on the ride side although the left thumb was sucked. Front view shows the distortion of the maxillary tissues toward the left. Occlusal view illustrates the deep palatal depression at the site of pressure.

Fig. 6.—Two other cases showing palatal depressions at the sites of thumb force. Teeth and soft tissues are in positions mesial to normal.

Fig. 5 shows models of the exceptional case. The left thumb was used with the hand held far enough to the left to allow the third finger to scratch the side of the nose. The arm was twisted and unsupported. Thumb pressure was necessary to steady the hand and to relieve fatigue in the arm. Force was thus exerted in an anterio-leftward direction. During sucking, the left cheek was relaxed but the right one was drawn tightly against the maxillary buccal teeth.

The results of these forces are apparent. The bone was distorted leftward and anteriorly, carrying the teeth along with it, as shown particularly well by studying the median line. There was no retrusion of mandibular incisors. The definite palatal distortion is seen at the site of pressure. If the force were to bring about Class II relationship, it would necessarily be on the opposite side of the mouth.

Fig. 6 illustrates two more of these characteristic palatal depressions. *A* was caused by the left thumb and *B* by the right index finger with the palm held mesially. As can be noted, the buccal teeth are in mesial position and the rugae are anterior on the corresponding sides. Such depressions in the palate are not obliterated but remain as permanent records of the existence of the habits during the growth years.

It seems needless to reassert here that bone invariably yields and conforms itself to force exerted upon it. That is the bedrock principle of orthodontic treatment. Nor that yielding and conforming are most rapid in the plastic age of infancy. These habits in these Class II Division 1 Subdivision cases were all in existence in infancy. It is unreasonable to believe that the effects of a force sufficient to distort the palate permanently would be limited to the site of the force. It seems far more logical to think that the adjacent bone of the ridge also was distorted anteriorly; that it carried the buccal teeth in their crypts along with it and that they erupted into positions mesial to normal. That appears to be a reasonable assumption as the mesiodistal malrelation was as complete in the three- and four-year-old children as in the older ones.

Since these indications were discovered recently, search has been made for evidence to prove or disprove them. The photographs of these children did not show the lack of mandibular development characteristic of distoclusion. In fact, there were several unusually fine specimens of mandibles.

Survey of the Stanton method was corroborative. It showed that in these malocclusions the maxillary buccal teeth on the sides affected were mesial to normal.

Thirty-one other Class II Subdivision cases have been investigated. The frequency with which they have been found in accord with these findings is very convincing. Two of them were Division 2 Subdivision cases. It may be that in those instances the malrelation of the buccal teeth was established by the habits early in life as Division 1 cases; that later when the habits which caused the incisor protrusion were stopped, those teeth assumed the typical positions of Division 2 Subdivision.

No one would expect self-correction in any of these twelve subdivison cases. Such malocclusions are often difficult to correct and maintain, even with skillful orthodontic treatment. The data presented seem to throw some light on why that is true. If the premise is correct, it would mean that in such cases there is not merely forward movement of teeth but also gross distortion of the bone and soft tissues during growth.

CONCLUSIONS

1. Thumb- and finger-sucking are very prevalent habits among American children.

2. Malocclusion is present almost invariably while the habit is in force.

3. Three major abnormal forces are exerted during thumb- and finger-sucking. One is passive and two are active.

4. The habits aid in causing malocclusion by mechanically inhibiting or exaggerating the inherent process of growth.

5. The kind and the degree of effect depend upon the method of the habit.

6. Pernicious secondary habits of the tongue and lips and of mouth breathing are formed and frequently persist after the thumb-sucking ceases.

7. Abnormal pressure of the cheeks during sucking was found closely associated with deficiency of later arch growth.

8. Abnormal muscular pressure of the thumb or finger against the palate apparently is a most important factor in the etiology of Class II malocclusion.

9. There is tendency toward self-correction of the simple types of anterior malocclusions upon cessation of the habit, provided that secondary habits are not factors also.

10. Self-correction of the gross forms of malocclusion influenced by thumb- and finger-sucking is unlikely even if the habits are stopped in early childhood.

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ORTHODONTIC EDUCATION*

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ORGANIZATION of professional men is very important for a variety of reasons. An organization such as yours is especially important in stimulating worthy purposes and in discouraging what might be called undesirable purposes. Every national organization of this kind, every state or local organization, is naturally inclined to put forward those things that represent honorable ambition and fine purpose. Your Society has been exemplifying that type of advantage in organization by promoting ideals which are essential factors in all good organization. You, naturally, afford protection for the professional type of service that you render. You give it a certain amount of support by your mutual collaboration, which otherwise it might not receive. By promoting the welfare of the public avowedly, and even when not so declared, you show the great advantage of organization: for when men are banded together for professional purposes the public interest, as well as the professional interest, becomes very obviously an impelling motive. Then, of course, organization promotes individual development and individual advantage, and stimulates the aspirations for personal development, personal betterment, and the acquisition of improved and more effective skills.

I am not sure that I assume correctly why I was invited to address you today—presumably to discuss some educational principles. I have concluded that a few remarks, for a few minutes in this field, may be of interest to you. As a layman engaged for some years very actively in the study of dental education, I recall that during the years 1921 to 1926, when the work was done under the auspices of the Carnegie Foundation, I was very sharply impressed by the fact, as I went among the dental schools, that, although orthodontics was rated by all concerned as very important in terms of welfare for the children—which was the main object of its interest and activity—the dental schools were not satisfied with their own endeavors to teach it. At that time there were many proprietary courses and private facilities for the acquisition of the knowledge which, it was conceded, the dental practitioner did not then have; which he was not able to acquire at the schools; but which, by special individual effort, he was under obligation to obtain, if he were to practice orthodontics. The ability, devotion and self-instruction of exceptional men, and some proprietary and private facilities that provided graduate opportunities in orthodontics for those who sought them, stimulated and had been sustaining the development of your specialty, the growth of which has been a notable feature of modern dental progress.

*Condensed, by the author, from the stenographic record of an extemporaneous address at the annual meeting of the New York Society of Orthodontists, Waldorf-Astoria Hotel, New York City, March 7, 1938.

I remember that I also derived certain impressions of this kind related to oral surgery. Finally I concluded that there were two outstanding divisions of dentistry that were not effectively taught in the schools, and which should be the subjects of very carefully organized and efficiently managed graduate courses to take the place, in universities, of the shorter, limited and more or less ineffective courses in orthodontics under private auspices. So, leading up to final conclusions in that relation, it was suggested that graduate courses be definitely established to promote the advancement of orthodontics as a specialty of dentistry, because of its importance to the public welfare and the practical difficulties attending its instruction in the undergraduate curriculum.

Among the statements made in the *Carnegie Foundation's Bulletin on Dental Education** as an outcome of that study were these, which may be quoted as illustrating the Foundation's support of the foregoing conclusion. One quotation is this: "Certain aspects of dentistry, especially the most intricate mechanically, the most difficult esthetically, or the most responsible medically, cannot be practiced expertly without extended experience or supplementary special training." This was intended to be a generality. Following it were numerous details regarding the inadequacy of the proprietary, private, inept, superficial, undesirable type of school.

Another quotation is this: "The schools of dentistry, like those of medicine, have not yet attempted seriously the task of training specialists in dental practice . . . and with a few exceptions provide only undergraduate curricula." This was a statement in accord with some of the generalities to which I have already alluded.

Another quotation might be cited: "The obligation of the dental schools in universities to provide systematic graduate curricula for the training of specialists of all types of oral health service [including orthodontics] . . . is clear and urgent."

Such statements as these are scattered throughout the volume, and may be regarded as expressions of the opinions twelve years ago of one of the leading educational organizations regarding the importance of orthodontics from the standpoint of the public welfare and the desirability of conducting university-established and university-standardized courses in this field.

Today you are justly proud of the marked progress your specialty is making, and yet I am sure you are eagerly anticipating further improvement. You have noted with gratification the diminution in the number of private courses of instruction in orthodontics and the increase in the number of university endeavors—now numbering 13—to promote orthodontics by and through courses of the kind that are worthy of your best aspirations and of your highest self-respect. In the educational field you will certainly wish to promote—by your advice and your support—the very best the universities can offer, year by year as orthodontic knowledge increases and orthodontic opportunity expands.

*Carnegie Foundation's Bulletin Number Nineteen, 1926.

In my references to private courses as less desirable than university courses, for the *further* evolution of orthodontics, I do not disregard the past service of private courses and have no illusions regarding university courses. I do not suggest that when a thing is done in a university it must be perfect because it cannot be imperfect. Faculties in every university are groups of human beings having all the common human infirmities. But when this is conceded, it still is true that the university presents the best educational opportunities, for this outstanding reason—the universities attract to their service many of the most competent teachers in every field of learning. The universities assemble many of the most altruistic men and women; many of those most generously devoted to the public service; many who give nobly of what they have for the advancement of others so that the public welfare may be advanced. So far as human frailty permits, the university congregates in its faculties—at any time in any community—many of the ablest, most earnest, and most effective teachers. They are grouped into departments for research and teaching and are available in their respective branches for orthodontic as well as other courses in the university. If, therefore, universities cannot do the best for the educational advancement of any aspect of learning, it is probable that only remarkable exceptions can afford better opportunities.

The present objection to the proprietary teaching institution is based on relative considerations. As I said at the outset, some of the past proprietary and private facilities for graduate instruction effectively stimulated and sustained the development of orthodontics. Many teachers in proprietary schools have been men of the highest intellectual and moral quality. But where, in educational institutions, the profit motive is dominant, and where dividends on invested capital are paid from tuition fees, the ensuing desire of managements to obtain dividends tends to deprive the system of instruction of some of the qualities that extra philanthropic funds would assure. What orthodontics needs is not additional good proprietary courses, but some graduate opportunities of the best possible kind. Through endowment and other special means, such as gifts, a university acquires resources that it can distribute directly or indirectly to students, without requiring commensurate tuition fees. A university school gives to a student, for his tuition fee, more than he would receive from a proprietary school, because the university's main aspiration is to give as much as possible on a basis of *public* responsibility and financial *generosity*. A proprietary school gives as much as possible on the basis of *private* responsibility and financial *equity*—chiefly to its owners. All other things being equal, any director of instruction can give more to students if he can use supplementary endowment-income for the purpose, than when tuition fees are the only sources of revenue—and some of the tuition receipts must be used to pay profits to owners. For these reasons alone you will doubtless wish to accord to all university endeavors in orthodontics your very best encouragement and support.

These general remarks have been intended to stimulate your ambitions for the best possible educational and scientific advancement of your specialty.

In this spirit I shall conclude by repeating a sentiment expressed in a recent more formal address. To all orthodontists I make this direct appeal: "Follow impulses and leaderships that represent ideals; that point the way to your professional destiny; that express—in integrity, fidelity, service and lofty purposes—the finest that is in you individually and professionally." If you proceed along this route, your specialty will continue to deserve the highest professional esteem and the greatest public appreciation. I believe you are going rapidly and securely in this direction.

IMPACTED AND UNERUPTED TEETH AND THEIR RECOVERY

JACOB C. LIFTON, D.D.S., NEW YORK, N. Y.

INTRODUCTION

THIS paper will attempt to present, first, a background for the understanding of impacted and unerupted teeth and, second, an original method by means of which such teeth can be recovered without mutilation of the involved tooth and with a minimum of surgical disturbance to the surrounding tissue.

PART I

FACTORS CONTRIBUTING TO IMPACTIONS AND UNERUPTED TEETH

Racial Habits and Impactions

Man has existed countless centuries passing through numerous and varied civilizations. Throughout, his dominant struggle for survival has modified every era's mode of living, habits, and diets, and has, accordingly, influenced individual development. Man always has had his shortcomings, which from the dental aspect have been manifested then, as they are today, in tooth decay, periodontoclasia, and impactions.

Dr. Harold F. Curtis, of Alexandria, Egypt, in a masterly study, has presented interesting archeological evidence to show the relationship between the mastication habits of the ancient Egyptians and the presence of impacted teeth. He has shown that when their diets stimulated forceful mastication, there resulted massive bony jaw development which made available sufficient room to accommodate the full complement of thirty-two teeth. On the other hand, he has presented data which indicate that when a richer and softer diet was used, during periods of a higher culture, impacted teeth appeared.

There is, moreover, a relationship between the size of the jaw bone and the degree of attrition of the teeth. The larger the jaw bone, the more the teeth are worn down. Some of the attrition of the teeth must be attributed to the presence of mineral matter in the food due to a faulty method of grinding grain. To accomplish grinding, the ancient Egyptians placed the grain between two stones, one smaller than the other, the smaller one being applied in mortar and pestle fashion. Under these circumstances a great deal of abrasive substance found its way into the finished product, a factor of some importance in explaining the attrition of the teeth referred to by Curtis. The significance of this factor, however, must not be exaggerated, since the evidence seems definitely to indicate a clear relationship between size of jaw bone and degree of attrition of the teeth, indeed, between size of jaw bone and vigor of mastication. To quote from Curtis: "I have seen and carefully examined mandibles of the Meriotic Period without seeing an impaction or even the resemblance of one.

From the Dental Department, Bellevue Hospital.

"I never saw such a uniform lot, true to type; large bony supporting tissue for all teeth, and room enough for another molar distally to the third. They did have periodontoclasia and all suffered severely with attrition. The Predynastic Period showed a similar development and always the attrition so no-

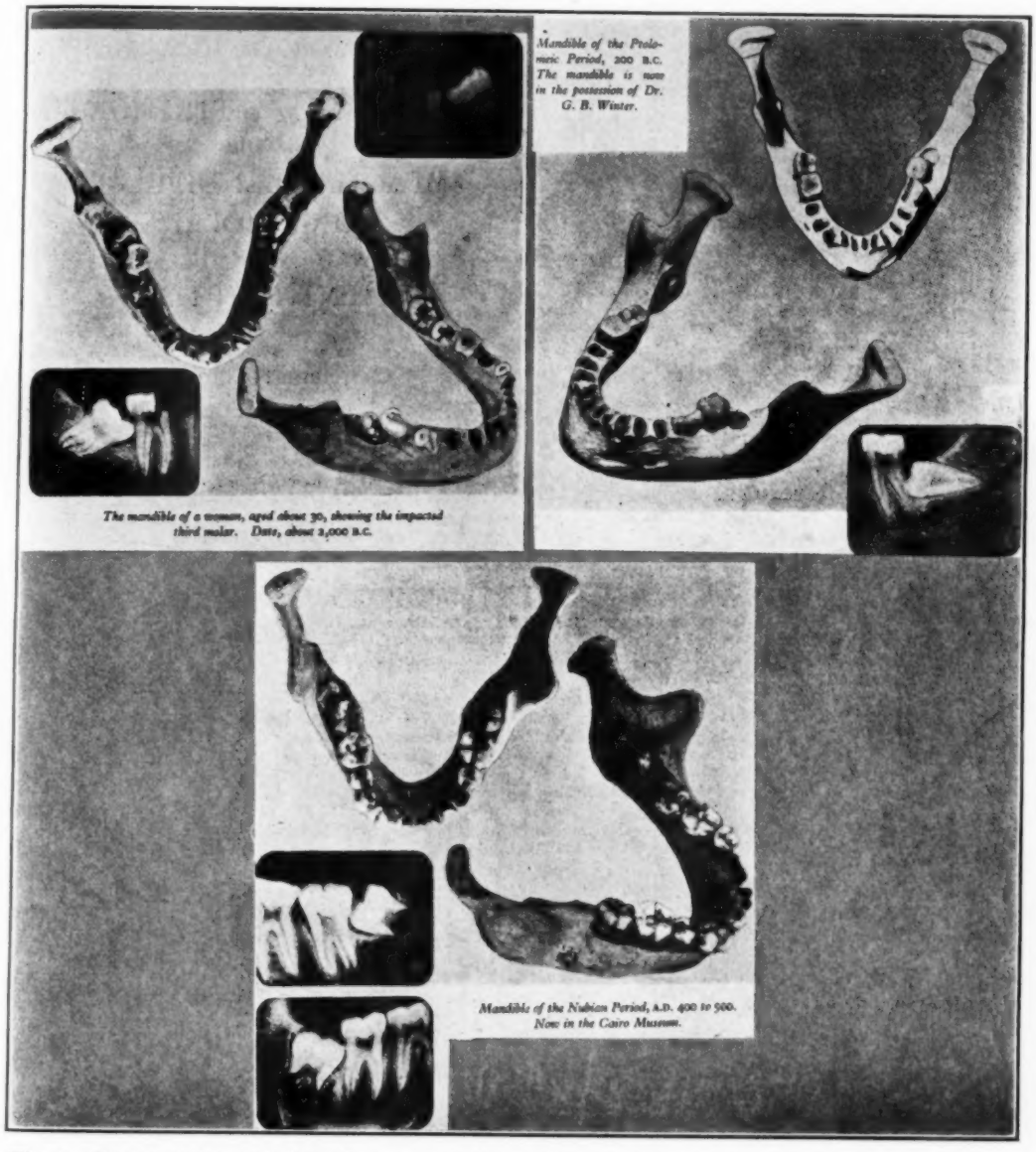
Mandible of the Ptolemaic Period, 200 B.C. The mandible is now in the possession of Dr. G. B. Winter.
The mandible of a woman, aged about 30, showing the impacted third molar. Date, about 2,000 B.C.
Mandible of the Nubian Period, A.D. 400 to 500. Now in the Cairo Museum.

Fig. 1.—These plates and legends are reproduced through the courtesy of Dr. Harold Curtis, of Alexandria, Egypt; and the American Dental Society of Europe.

ticeable in all ancient Egyptian people. Everywhere during these periods where attrition was their most serious dental ailment there were no impacted third molars.

"However, I have in my possession mandibles from later periods, with impactions, and have discovered in the Egyptian Museum in Cairo quite a number of impacted third molars in the mandibles of Egyptians from nearly all the

periods as far back as the middle Empire or about 2000 B.C. Still, these cases of impactions never show the same degree of attrition as the teeth in the mandibles where impactions were nonexistent.''

It is of interest that the skulls with impactions which Curtis discovered and exhibited corresponded to the periods during which the Egyptian civilization was at its zenith, to the eras when the Persians invaded Egypt, and to that when the Greeks imposed their civilization upon them. The foods introduced during those periods apparently required less mastication as evidenced by the fact that the cusps show less functional wear. This is also true of the period during which Roman influences were exerted. (Fig. 1.)

The progress of our present-day civilization encourages the consumption of soft prepared foods. These ultra-refined products, often lacking in vitamins and necessary body builders, require not only little oral digestion but also little chewing. The machine age has further complicated our existence with many trials, strains and worries which burden and sometimes overburden our nervous system.

We must always remember that the human body is composed of a conglomeration of cells which must perform all the functions of living matter if we are to live and to grow. These functions are segregated into groups of cells or tissues, differentiated into organs for the purpose of performing specific duties. These tissues and organs must work in harmony in order that we may adjust ourselves to our environment. The most important factor in the coordination, control and function of the various organs rests with the nervous system which transmits impulses from external surroundings as well as regulates the intricate internal interrelationships among the body cells. Hence any disturbance or impairment in the nervous mechanism is of considerable significance and exerts an incalculable force upon growth and development.

In view of the remarkable advances in medical sciences and the progress in surmounting some of the perils of our environment, man is enabled to live where in other eras or civilizations he would have succumbed to destructive natural forces. For example, the aboriginal tribes in the wilds of Africa live on natural coarse foods and the individuals composing them must be of good hardy stock, capable of withstanding or overcoming disease. Their newborn infants must be able to mature on primitive diet. During their formative years they must be possessed of unusual vitality to withstand adverse conditions. In other words, the weak do not survive and only the fit reach adulthood. Because of their mode of living and diet it is small wonder, therefore, that the aborigine should have an excellently developed jaw bone of sufficient size to accommodate a full complement of teeth.

In the light of medical advances, our modern life saving methods succeed in saving a substantial proportion of infants of poor constitutions and of poor physical background. During the crucial formative early years many formerly fatal illnesses are successfully treated, but they may leave a defect on the then developing body tissues. Perhaps the damage is irreparable or it may only hamper development and growth for a limited period. Since many diseases have oral manifestations or respiratory complications, can we not logically anticipate a retarding influence on the developing maxillae and mandible?

Developmental Factors and Impactions

It is well to remember that teeth are of prenatal origin and that very early in the embryonic development of the child the deciduous tooth buds are enfolded. To the lingual of the deciduous buds the permanent tooth buds are given off, from which will develop its permanent successor. From the ends of the dental laminae the first permanent molars are given off. At birth all the deciduous teeth and first permanent molars have been formed and are present in the maxillae and the mandible. The roentgenogram of the skull of a newborn infant discloses calcification of the deciduous tooth crowns and the beginning of calcification of the first permanent molars (Fig. 2). Soon after birth the permanent central, lateral and canine tooth germs differentiate, a process which is followed by calcification.

Fig. 2.—X-ray picture taken at birth, showing the deciduous dentition undergoing calcification and the beginning of ossification of the first permanent molar (indicated by arrow).

As the infant grows and develops, the deciduous teeth erupt. Usually by three years of age the deciduous dentition is completed and all the permanent teeth except the third molars are already formed and beginning to calcify.*

Largely as a result of functioning of the deciduous teeth the body of the mandible develops; the ramus and its processes take on a more definite form and its angle becomes less obtuse. By the time the first permanent molars are about to appear there are developed sufficient spaces for them posterior to the

*Although it is unusual for a deciduous tooth to fail to erupt, a child two and a half years old was seen at Bellevue Hospital with a full complement of deciduous teeth except the maxillary right deciduous central incisor which the radiograph disclosed as unerupted.

last deciduous molars. There is also a lateral growth in the incisal region. As a result, spaces appear between the anterior teeth to accommodate the larger and wider permanent successors.

Normally the roots of the deciduous teeth are resorbed and their crowns exfoliated. Then the permanent successors take their places in the dental arch. This sequence, however, does not always occur, as the permanent tooth may remain embedded long after its usual time for eruption through the gums. The roentgen ray may disclose an unerupted tooth wedged in between two adjacent teeth, locked against another tooth or held by impinging bone. Since the direction of growth is in line with the long axis of a tooth, a malposed unerupted tooth's position may be such as to inhibit its movement beyond the mucous membrane of the oral cavity, no matter how favorable the inherent eruptive force may be. A tooth in any of the above situations is impacted. Although the position and presence of sufficient space in the arch, and direction of movement of a tooth may all be favorable for emergence, yet emergence of the tooth may not take place because of obstructing factors or possibly lack of sufficient normal growth force. Such a tooth is classified as an unerupted tooth.

Disuse of the teeth as a result of caries, diminished function caused by the early loss of teeth, lazy mastication habits, or interstitial bony changes in its supporting structure produced by rickets, scurvy, exanthematous diseases, injury, etc., will retard lateral growth of the deciduous arch. As a consequence there will be insufficient room to accommodate all the permanent anterior teeth in normal alignment. The permanent central incisors, however, may emerge and take their proper places in the arch. Therefore, the space left for the accommodation of the permanent lateral incisors must be less than adequate to receive them. Nevertheless, the permanent lateral incisors might also assume their regular position in the arch, but in so doing, they would erupt at the sacrifice of the deciduous cuspids. Under these circumstances, as a result of the pressure of the growth force and the proximity of the developing permanent lateral incisors to the deciduous cuspid root, resorption of the deciduous cuspid root (or roots, if bilateral) would take place. This process would be followed by the exfoliation of the deciduous cuspid crown leaving the permanent lateral incisor in contact with the deciduous first molar. Obviously no room for the accommodation of the permanent cuspid, first and second bicuspids would be present in the mandible. Therefore, the process of resorption continues and attacks the first and second deciduous molar roots, which is followed by the exfoliation of both deciduous molar crowns. The cuspid and first bicuspid erupt and usually utilize all the space available between the lateral incisor and the first permanent molar, leaving no room for the second bicuspid.

The resorption of a deciduous tooth root other than by its own permanent successor in the arch follows the extraction of the deciduous lateral incisor, a practice resorted to, to relieve an anterior crowding or to provide space for a permanent central incisor erupting lingually. Such a practice is strongly contraindicated not only because it aggravates an already contracted arch but also because it eliminates any benefit which would be derived from normal tongue pressure. Such pressure, exerted on the lingually placed tooth, stimulates lateral and forward development of the anterior segment of the arch. The ill-advised

extraction of the deciduous canine to make room for a lateral incisor erupting lingually is exceedingly harmful because the cuspid occupies a unique position in maintaining the arch contour, and with the removal of this important element the arch collapses. The premature loss of the deciduous canine, from any cause whatsoever, such as caries or injury, is likewise unfortunate. Since the sequences of eruption of the mandibular incisors, canine, and first bicuspid usually precede the second bicuspid, the damaging effect will fall upon the last tooth to erupt; namely, the second bicuspid, which might be locked between the first bicuspid and the first permanent molar. Should a deciduous second molar be lost prematurely, the space it occupied will be closed in by the drifting of adjacent teeth. This may bring about the wedging of the succeeding bicuspid and its failure to erupt. And again, should the first permanent molar be extracted before the second bicuspid has been fully formed and erupted, the normal approximal tooth pressure would be released. Then there would be a tendency for the developing second bicuspid tooth germ to migrate and incline. Thus with its direction of growth deflected, the second bicuspid may become locked in the bone and a horizontal impaction of the bicuspid would result. (Fig. 7*A* and 7*C*.)

The prolonged retention of the maxillary deciduous canine and the failure of the deciduous canine root to resorb may result in a deflection of the permanent canine tooth germ. It should be remembered that the developing maxillary permanent canine is situated high up in the bony process of the maxillae and erupts after the lateral incisor and first premolar are in position in the arch. Therefore, any factor that retards the arch development in the canine region or interferes with the direction of the developing tooth germ renders the canine susceptible to impaction.

Similarly, the third molar is found deep in the bone distal to the second permanent molar and begins calcification about the ninth year. Due to functional stimulation from mastication as well as normal and germinal tooth growth, the mandible grows upward, forward and outward while the maxilla grows downward, forward and outward. Accordingly, by the time the third molar is ready to erupt there should be sufficient room gained behind the second permanent molar for the accommodation of the third molar. Should there be, however, any impingement in the way of the growing tooth germ or insufficient development in that region the third molar will be deflected in its direction of growth and impaction will result.

The prolonged retention of deciduous teeth or retained roots, odontomas, presence of scar resulting from injury, local inflammation, and abscessed deciduous teeth may prevent a tooth even placed in a favorable direction from emerging.

Part II*

Thus far an endeavor has been made to portray the circumstances surrounding impactions and unerupted teeth. Part II, however, will deal with the importance of the recovery of these teeth and a practical method of achieving it.

*Presented as a table clinic before the New York Society of Orthodontists, New York, N. Y., March 17, 1937; and before the American Dental Society of Europe, at Paris, France, August 3 and 4, 1937.

DISTURBANCES ATTRIBUTED TO IMPACTED TEETH

To impacted or unerupted teeth are sometimes attributed the resorption of roots of adjoining teeth, neuralgias, reflex disturbances, and even general systemic disorders. Occasional pains are also ascribed to impacted or unerupted teeth. Such pains have been explained as due to pressure reflexes incidental to spurts of growth of the impacted tooth.

We must also bear in mind that nature intended the impacted or unerupted tooth to be part of the masticatory apparatus. Indeed, each and every tooth in the human denture has a shape, size, specific purpose, and definite position in the dental arch and therefore is individually necessary to maintain the contour of the arch and to secure the proper harmony in their interdigitation with their normal antagonists. Since the impacted or unerupted tooth has a definite function to perform, every effort should be made to recover that tooth and to restore it to function.

To accomplish this it is necessary to study each individual case as presented. The treatment of some cases, from the orthodontic aspect, merely requires the securing of sufficient space for the impacted tooth, and when this is attained the tooth will emerge through its own inherent eruptive force. Other cases require surgical intervention as well as orthodontic aid.

Heretofore, when a patient with an impacted tooth presented himself for orthodontic treatment, after the necessary preliminary procedures were disposed of, the impacted tooth was localized radiographically, the crown of the involved tooth exposed surgically, a cavity drilled into it and a spur, post, or eyelet constructed and cemented into this prepared cavity. The attachment in the tooth was ligated to an orthodontic appliance and the tooth brought into position in the arch. The preparation of the cavity for the reception of the post was not always an easy one and the cementation of the post was even more difficult. This method accomplished the purpose of bringing the tooth into position but had the disadvantage in that it was necessary to drill a cavity in the impacted tooth, sometimes on a surface which later would be very conspicuous when exposed to view and thus mar the tooth esthetically. The cavity had to be prepared rather shallow with its accompanying disappointing results because of the unfavorable position of the tooth and the proximity of the floor of the cavity to the pulp, and the size of the pulp due to the age of the patient. To eliminate these disadvantages, a method was devised of constructing and cementing a cast onlay with an eyelet for the ligature, on to the impacted tooth. Whenever the onlay remained cemented, it served its purpose well. However, taking the impression for the construction of the onlay, as well as its cementation, also presented difficulties. To overcome them I suggest the method I have devised to recover the impacted tooth by applying finger spring pressure directly on the involved tooth.

Fig. 3.—*A*, Moulage of patient before treatment, reproduced from impressions taken with mouth open. Doorlike sections thrown back to show lingual appliance in position and finger spring engaging exposed canines (arrows indicate retained deciduous canines).

B, Moulage after treatment, with teeth in occlusion showing the permanent canines in normal position and alignment.

C, Radiographs taken before treatment, revealing impacted canines.

D, Occlusal film to localize impacted canine in relation to appliance.

E, Occlusal film with appliance in position, finger spring engaging surgically exposed canine.

F, Occlusal film with base plate gutta percha plug used to control hemorrhage if necessary.

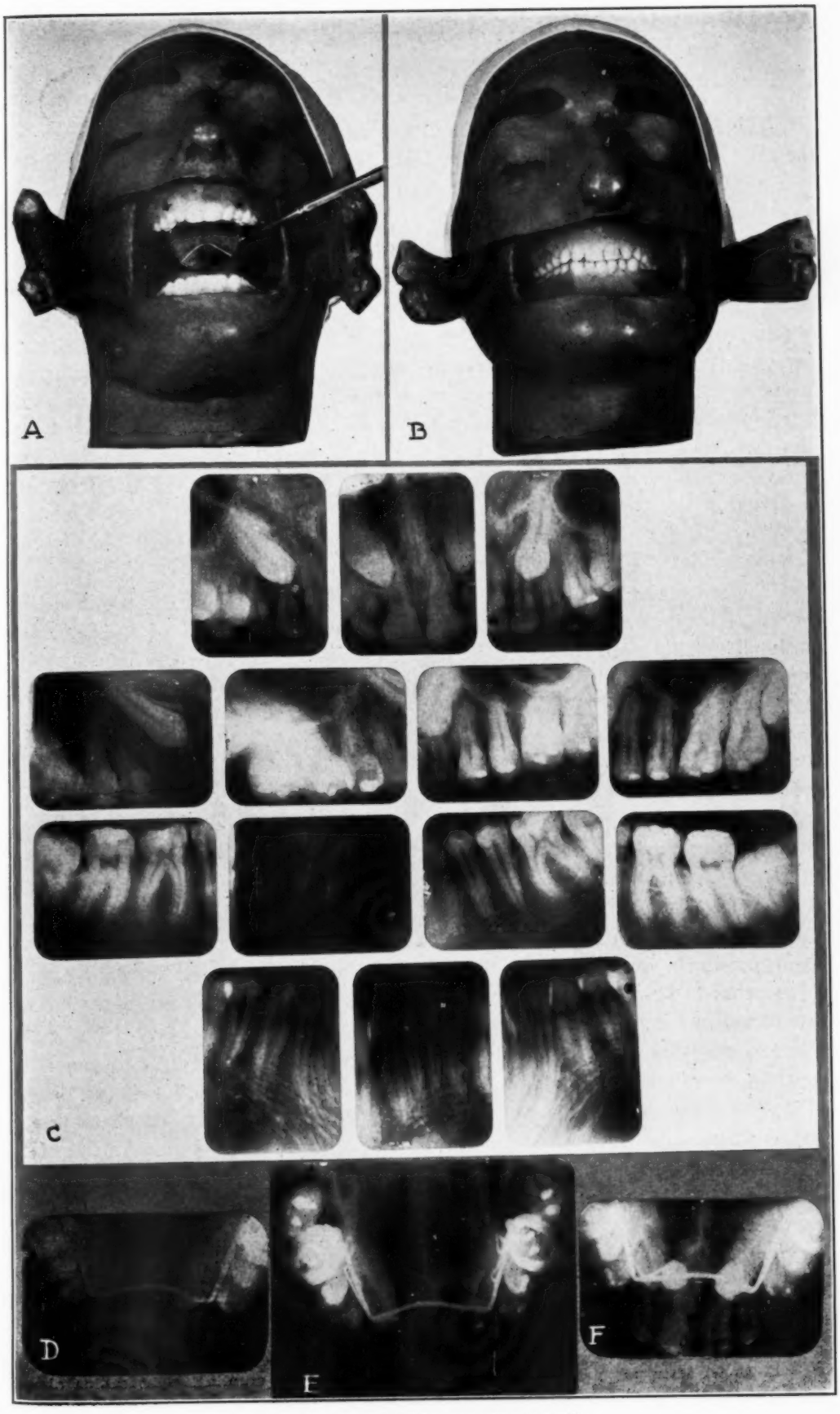

Fig. 3.—See opposite page for legend.

APPLICATION OF DIRECT SPRING PRESSURE

The following cases illustrate and describe the method used to accomplish the recovery of the impacted tooth or teeth by direct spring pressure.

P. M., young man, age 19 years; examination showed both deciduous maxillary canines still retained in position (Fig. 3*A*). The x-ray pictures revealed two horizontally impacted permanent canines lying across the palate behind the incisors (Fig. 3*C*). A Mershon lingual appliance was constructed using two molar bands with half round tubes and inclined plane spurs soldered to the lingual surface for the reception of the half round wire and locking spring device. The lingual appliance was designed and shaped so that it would not interfere with the impacted teeth when they erupted into the mouth. The bands were cemented into position with the body wire in place, and an occlusal film was taken to localize the impacted teeth in relation to the body wire (Fig. 3*D*). The lingual appliance was removed and a recurved finger spring 24 gauge in thickness was soldered to the palatal surface of the body wire and shaped to follow the outline of the heavier wire (gauge 18). Ample length of wire was left to permit the shaping of the finger springs.

The crowns of the impacted teeth were exposed surgically. At this sitting the finger springs were contoured to engage the mesial aspect of the impacted teeth. The ends were balled in the flame, then flattened with the band stretching pliers. Thus the direction of the application of force was controlled, and at the same time, the grip on the teeth was improved to prevent dislodgment. The appliance was inserted (Fig. 3*E*) and the patient dismissed. Should it be necessary to control capillary oozing, the finger spring can be used to hold a strip of iodoform gauze in place. Should a profuse hemorrhage occur, which happens rarely, the finger springs can easily be utilized to hold a base plate guttapercha plug, underneath which can be inserted a very small strip of iodoform gauze (Fig. 3*F*). If necesary, pressure can be applied through the finger spring and the hemorrhage controlled.

The movement of the canines was accomplished by tightening the finger springs using a downward and buccal direction of force. It required almost three years to bring the impacted teeth into normal position and alignment as illustrated in Fig. 3*B*.

Examination of M. D., girl, age 15½ years, showed a neutroclusion with contracted arches, the maxillary canines and second permanent molars missing (Fig. 4*A*). The x-ray pictures revealed unerupted second molars in their proper position and direction, while the canines appeared to be impacted lingually (Fig. 4*B*). A closer study showed the left canine to be horizontal, lying deep in the palate to the lingual of the apices of the bicuspids, the crown extending almost to the lateral incisor. The right canine appeared to be in a more favorable

Fig. 4.—*A*, Moulage, before treatment, with appliance in position and finger spring engaging exposed canine. Note design of appliance to eliminate possible interference with erupting canine.
B, Radiographs before treatment showing impacted canines.
C, X-ray, occlusal view, showing appliance engaging impacted canine.
D, Buccal view of *C*.
E, Model after one year's treatment, showing left canine erupting, right canine almost in position (indicated by arrows).

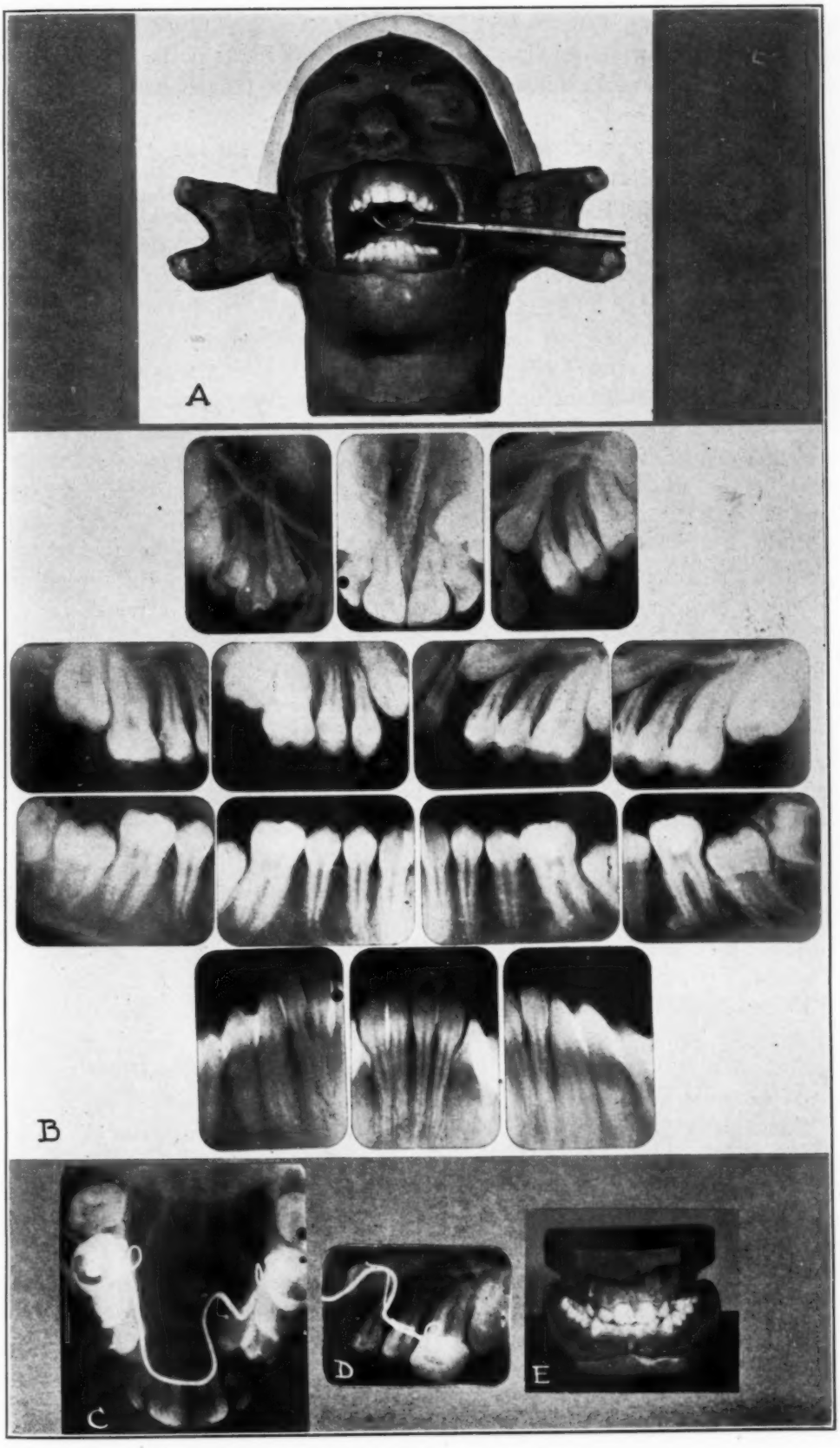

Fig. 4.—See opposite page for legend.

position than the left. The right lateral incisor was rotated; the space between the lateral incisor and first bicuspid was insufficient to accommodate the cuspid. It was decided to provide room for the right canine to erupt by orthodontic procedure alone and to resort to both surgical aid and orthodontic procedure for the recovery of the left canine.

Molar bands with lingual tubes were constructed as described in the previous case. The body wire of the lingual appliance was shaped to permit the left canine, when eventually erupting, to clear the body wire and at the same time provide protection to the delicate 24 gauge finger spring which was constructed similarly to that in the previous case. The bands were cemented. The surgery for exposure of the crown was performed by Leo Winter,* who describes it as follows, "Made a semilunar or semicircular incision proximating the region of the crown radiographically. The mucoperiosteum was laid back, and the removal of the overlying bone was best accomplished by means of a surgical bur. Following the complete exposure of the crown the flap was sutured back and then a window was cut out of the soft tissue covering the crown of the impacted tooth. To control the capillary oozing, a small piece of iodoform gauze was packed in the wound and held in place by the finger spring of the orthodontic appliance which was inserted by the orthodontist immediately after this operation. The gauze was removed in forty-eight hours and an uneventful recovery ensued."

The left finger spring engaging the canine exerted a downward force at first; later the force was directed downward and outward (Fig. 4*C* and *D*). The lateral incisors were rotated by means of a labial appliance. A progress model taken one year later showed the impacted left canine emerging in its proper place as a result of direct spring pressure (Fig. 4*E*). Although no direct force was applied to the right canine, it is now considerably erupted in the arch. It should be emphasized that this result was obtained without drilling into the impacted tooth.

N. H., girl, age 8 years, presented a distoclusion with a retruded maxillary left central incisor and an unerupted right central incisor with the deciduous central incisor still retained (Fig. 5*A* and *B*). The space between the right lateral incisor and right deciduous first molar was practically closed. A similar situation prevailed in the mandibular denture. The left lateral incisor was almost in contact with the left deciduous first molar, and the right lateral incisor was almost in contact with the right deciduous first molar. The deciduous central incisor had been extracted as well as a root remnant next to it. Although advised to expose the unerupted right central incisor surgically, this was not resorted to for reasons beyond the orthodontist's control. After the elapse of a year, the maxillary left central incisor was almost in the proper position, but the right central incisor seemed to have made no progress. It was then decided to modify the maxillary labial appliance by raising its position to a level above the elevation corresponding to the unerupted central incisor and thus exert pressure directly on the tissue. It is of especial interest to note that in a few weeks, without resorting to surgery, this tooth seemed literally to "pop out." Space

*Professor of Oral Surgery, New York University College of Dentistry.

was made for the maxillary right canine. In the mandibular arch the unerupted canines emerged through the gums after sufficient space was obtained for them. The mandibular arch was moved forward, and all the teeth are now in proper alignment (Fig. 5*C*).

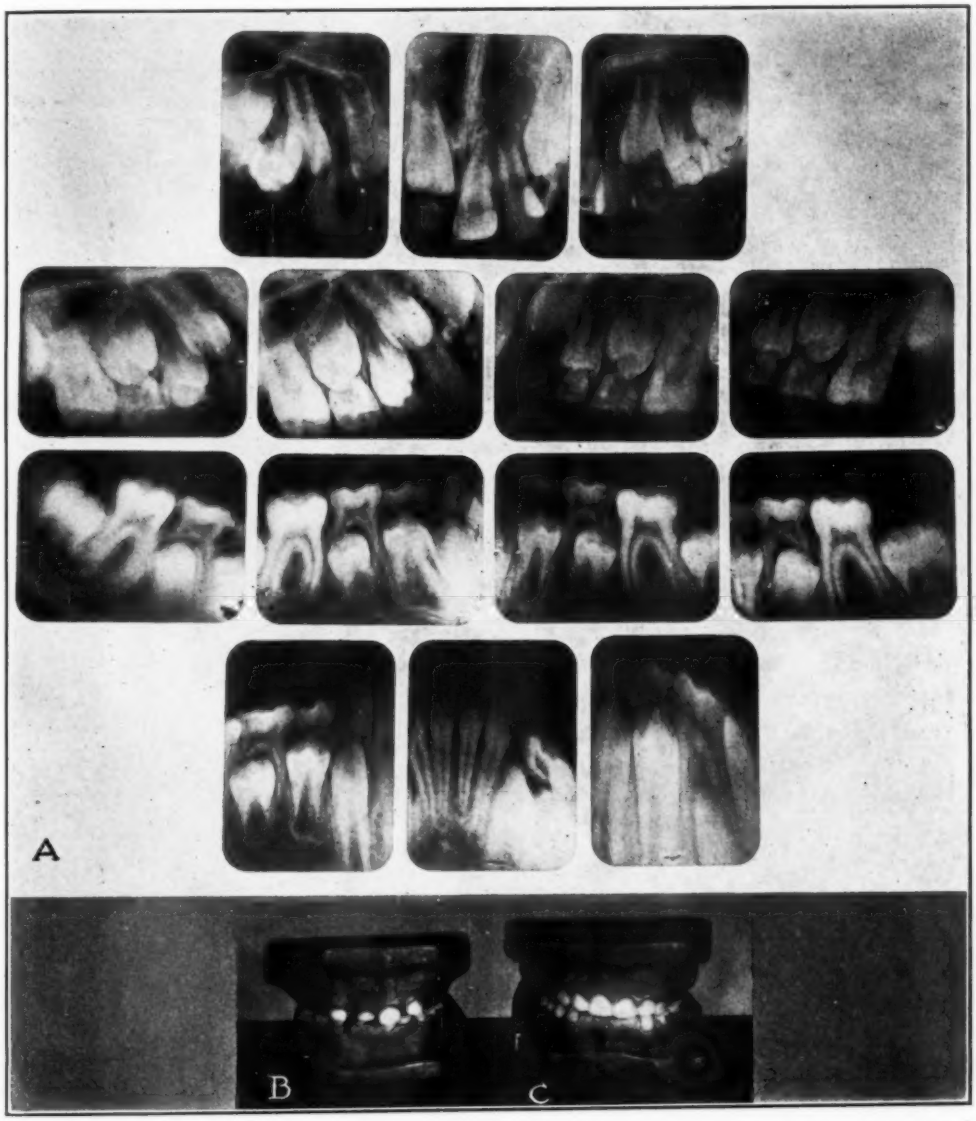

Fig. 5.—*A*, Radiographs before treatment, showing unerupted maxillary right central incisor, maxillary right canine and both mandibular canines.
B and *C*, models before and after treatment.

H. U., boy, age 12 years, has all his permanent teeth in position except the maxillary left canine and the maxillary left central incisor (Fig. 6*A*). He gave a history of a supernumerary tooth erupting after the deciduous central incisor was exfoliated. The supernumerary tooth was extracted two years before orthodontic treatment was started, but the permanent left central had not yet emerged. An anteroposterior x-ray picture revealed the left central incisor

impacted and inclined on a level with the floor of the nose (Fig. 6*B*). In the oral vestibule, the lowest descended portion of the tooth (distoincisal angle) reached a level corresponding to the mucolabial fold above the right central incisor. Molar bands were made with buccal tubes and cemented into position. A labial appliance was constructed with an inverted V-shaped bend in the region of the left central incisor to which was soldered a recurved finger spring. The

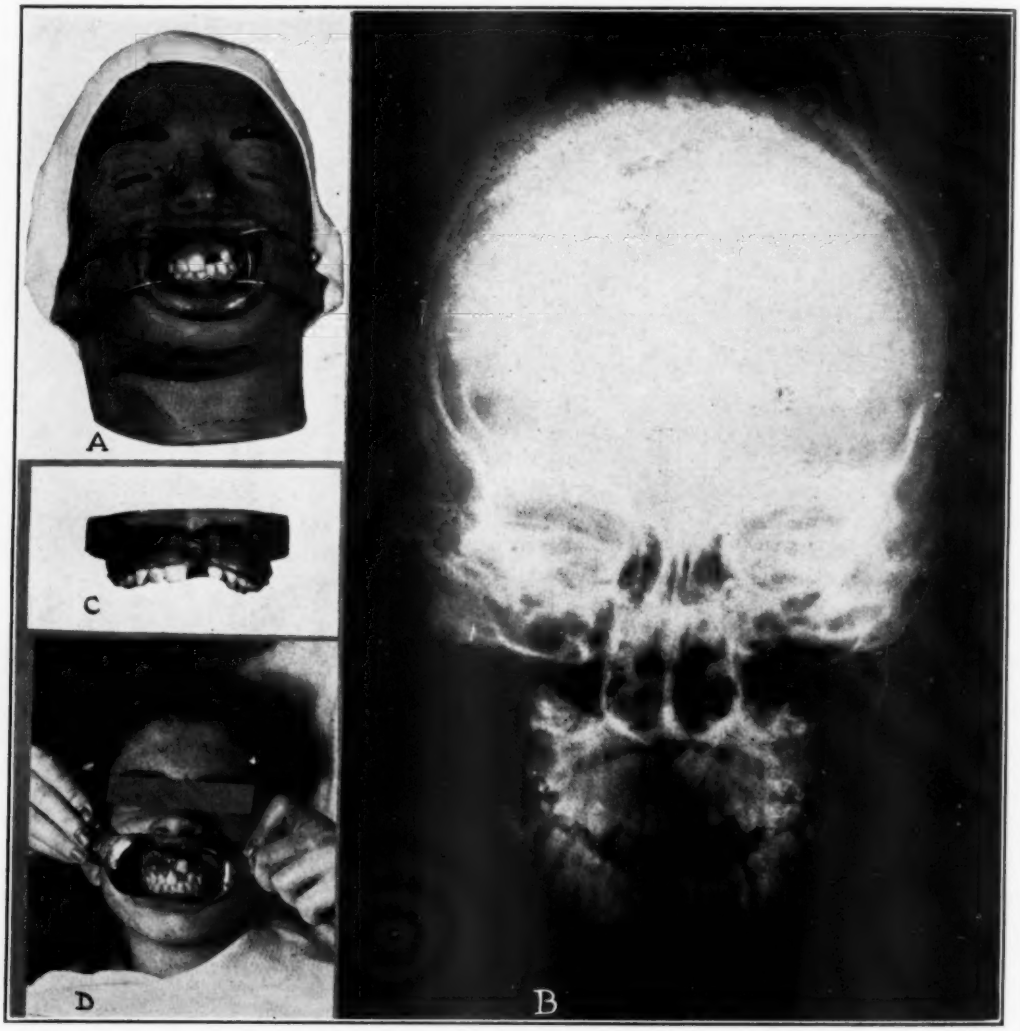

Fig. 6.—*A*, Moulage before treatment, with lips retracted.
B, Anteroposterior x-ray picture disclosing maxillary left central incisor near floor of the nose.
C, Model with appliance in position showing four months' progress.
D, Photograph of patient ten months later.

central incisor had been exposed surgically, the labial appliance inserted and the finger spring made to engage the mesial surface of the central incisor, through the guidance of the radiograph. The progress model, taken after four months' treatment, showed the central incisor visible midway between the mucolabial fold and the alveolar border. The type of appliance used is in position on the model (Fig. 6*C*). Photograph taken after ten months' treatment showed the

tooth descended to the alveolar border (Fig. 6*D*). It will eventually assume the proper position in the arch. Again, this result was obtained without mutilation of the involved tooth.

D. D., girl, 13 years old, presented a mutilated neutroclusion complicated by the loss of the mandibular right first molar, the noneruption of the mandibular right second bicuspid, and the impaction of the mandibular left second bicuspid .(Fig. 7*A* and *C*). A lingual appliance was constructed and inserted on the mandibular arch, banding the first molar on the left and the second molar

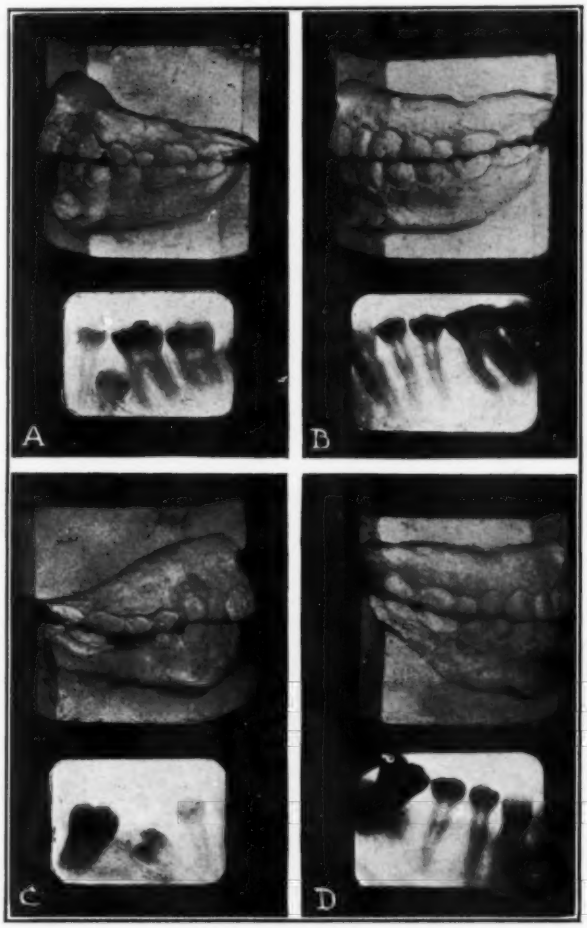

Fig. 7.—*A*, Model and x-ray picture before treatment, showing mandibular left second bicuspid wedged between first bicuspid and first molar.

B, Model and x-ray picture after treatment. Mandibular left second bicuspid recovered and in normal position.

C, Model and x-ray picture before treatment, disclosing horizontal impaction of right second bicuspid, first permanent molar missing.

D, Model and x-ray picture after treatment; second bicuspid recovered and in position. Note second molar brought forward to take the place of lost first molar.

on the right. After sufficient space was opened between the mandibular left first bicuspid and the first molar, the second bicuspid erupted as a result of natural growth forces, and assumed its normal position in the arch (Fig. 7*B*). The mandibular right second bicuspid, however, required surgical interference. The shell of bone overlying the bicuspid was removed surgically and an open loop

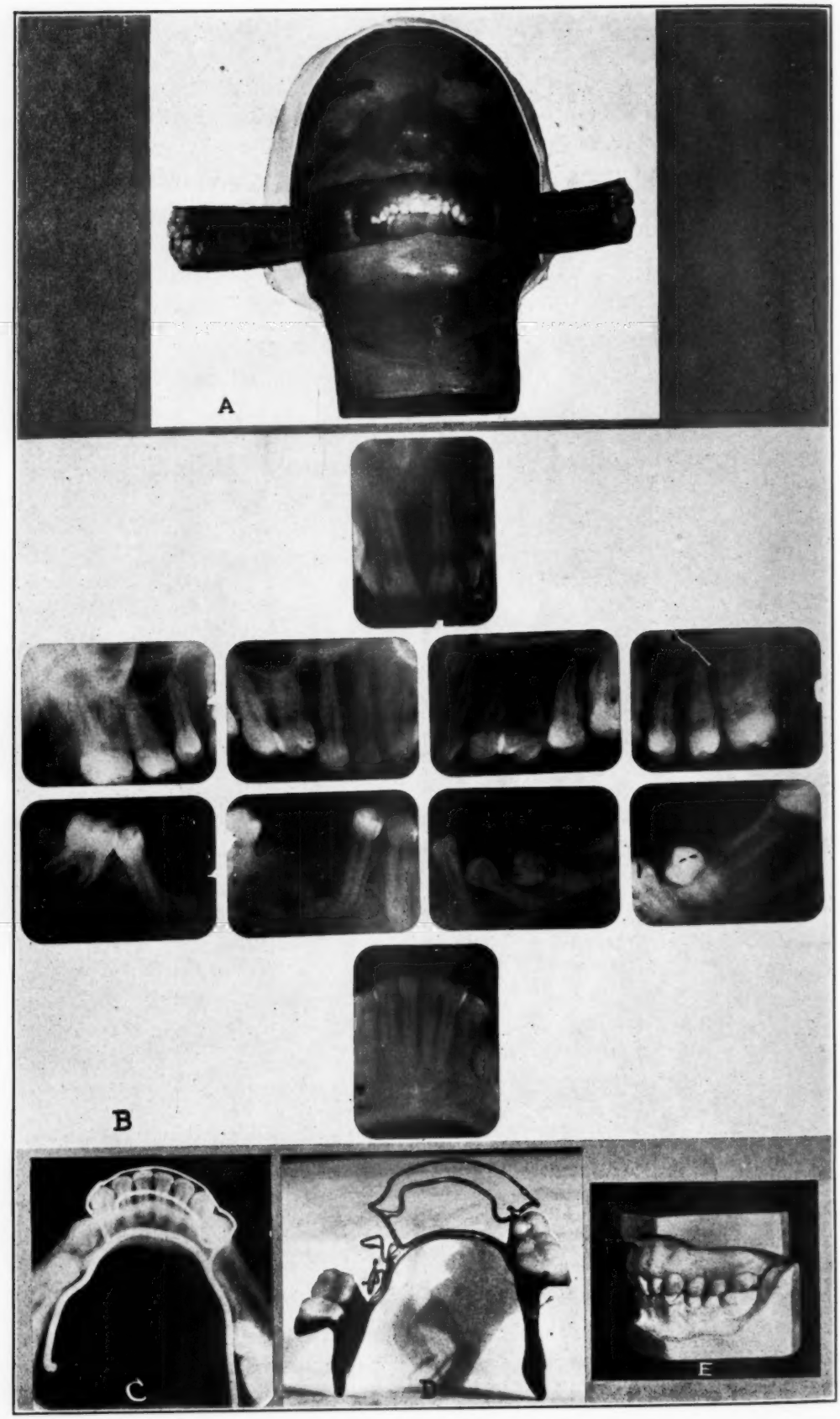

Fig. 8.—See opposite page for legend.

with a free extension to engage the distal of the bicuspid was soldered to the lingual appliance. The bicuspid was brought into position without drilling into the impacted tooth. The mandibular right second molar was brought forward into the space previously occupied by the first permanent molar, the third molar erupted and assumed the position of the second molar (Fig. 7*D*).

R. B., girl, age 15 years, presented a mutilated occlusion with a closed-up facial expression, with no teeth present in the mouth distal to the mandibular left canine. On the lower right side no teeth were present distal to the first bicuspid. The maxillary left bicuspids and molar grew down and almost occluded with the mandibular gum tissue, while the mandibular anterior teeth bit into the palatal tissue (Fig. 8*A*). The x-ray pictures revealed two impacted mandibular left bicuspids and an unerupted left third molar; on the right side an unerupted second bicuspid adjacent to the unerupted third molar (Fig. 8*B*). This case presented the problem as to what type of appliance would furnish the necessary anchorage to enable us to recover the left bicuspids, to guide the unerupted third molars into their proper positions, to open the bite, to prevent the maxillary left bicuspids and molar from further elongation, and at the same time to provide immediate function to all teeth then present in the mouth. The mandibular anterior teeth, because of their size, shape, and position, were unfavorable and insufficient for anchorage. In this case to fulfill all requirements for an adequate appliance, it was necessary to devise additional anchorage to that which the few teeth present in the mandible could supply. This was achieved by using a tissue bearing vulcanite saddle as an auxiliary anchorage. Accordingly a combined gold lingual bar plate and orthodontic appliance was constructed. An all round gold wire (gauge 14) was contoured. A Hammond splint was fitted over the anterior teeth and joined by soldering to the heavy lingual body wire. The appliance was placed in position and a radiograph taken in order first to ascertain the best position to solder the 24 gauge finger springs on to the heavy body wire, and to mark the limits for the vulcanite saddles with flanges extending lingually behind the third molar regions (Fig. 8*C*). Porcelain teeth were set into the vulcanite saddle to provide function for the maxillary bicuspids and molars and to open the bite. The finger springs were soldered to the bar before vulcanization. The light finger spring wires were used to recover, stimulate and guide the eruption of the impacted bicuspids. The bicuspids were exposed surgically, and the combined orthodontic appliance and prosthetic restoration was inserted (Fig. 8*D*). Pressure was exerted on the exposed bicuspids through the light finger springs. After one year's treatment

Fig. 8.—*A*, Moulage before treatment. No teeth present in the mouth distal to the mandibular left cuspid or mandibular right first bicuspid. Maxillary bicuspids and molar elongated and almost in contact with the mandibular alveolar gum tissue. Mandibular anterior teeth bite into palatal rugae.

B, Radiographs before treatment, disclosing impacted and unerupted teeth.

C, Occlusal view with Hammond splint soldered to lingual bar and in position. X-ray picture used to guide position in soldering finger springs to engage impacted bicuspids after surgical exposure and to mark limit for vulcanite saddle without impinging on unerupted third molar on left, and unerupted second bicuspid and third molar on right.

D, Photograph of combined orthodontic appliance and lingual bar. Note finger springs to engage impacted mandibular left first and second bicuspids, and right second bicuspid.

E, Model, left view, showing impacted bicuspids recovered and occluding with maxillary teeth.

the mandibular left impacted bicuspids and right second bicuspids were present in the mouth, occluded with the maxillary teeth, and were restored to function (Fig. 8*E*).

SUMMARY

Archeological evidence proves that the impacted tooth is not an anomaly peculiar to our present-day civilization alone, but was present in the various ancient Egyptian civilizations. It also indicates that impactions resulted from lack of room in the dental arch due to faulty diet and other factors peculiar to their civilization.

Developmental evidences show that the impacted tooth is the last tooth to erupt in its particular segment of the arch and that unerupted teeth are prevented from emerging due to obstructing anomalies.

Impacted and unerupted teeth were intended to serve a definite function in the human denture and should be restored to normal alignment and function in the arch.

In all the cases cited the various impacted and unerupted teeth were restored to function by applying the finger spring pressure directly to the impacted tooth immediately after surgical exposure, without resorting to cavity preparation in the tooth involved.

I wish to express my gratitude to Dr. Harold F. Curtis, of Alexandria, Egypt, for permission to use the material and plates published in the Transactions of the American Dental Society of Europe (1935); and to Dr. Leo Winter of New York, N. Y., for his contribution. to this work through the application of his technique in the surgical exposure of impacted teeth and for his cooperation in assigning patients with impacted teeth from the Dental Department to our Orthodontia Clinic in Bellevue Hospital, New York, N. Y. A few cases from the hospital were selected and are included in this article.

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ORTHODONTIC MODEL FORMER AND FACE BOW

Instruments and Technique for Making Plain Orthodontic Models and Models Related to the Eye-Ear and Orbital Planes

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THE object of this clinic is to present some instruments and a technique for the making of orthodontic models. Before describing the instruments used, it may be well to point out the novel features of the technique employed.

1. The impressions are taken as a separate operation, independent of the adjustment of the face bow. This enables the operator to use any method of impression taking and any impression material, including plaster.

2. The face bow, while it is being adjusted to the face, is held firmly in position by the patient biting into a metal bite-fork covered with wax.

3. This same bite-fork and wax bite is used to transfer the model to the model former.

4. The models may be made any desired height.

By this method the work on the patient is reduced to a minimum.

INSTRUMENTS

Face Bow.—(Fig. 1.) The first instrument is a face bow which consists of a U-shaped bar (*A*) with a horizontal slot in front. Attached to the bow by means of a thumbscrew is a mouthpiece (*B*) with its end sliding through the slot. Sliding on the *U* bar are four pointers (*C*) which can be fixed in any position by means of setscrews (*D*).

How to Use It.—Some bite wax is softened in the Bunsen burner and rolled into a thin roll, which is then placed on the forked part of the mouthpiece (*E*). The mouthpiece is now placed in the patient's mouth, and the patient is asked to bite into the wax until the metal mouthpiece is held rigidly by the teeth (Fig. 2). While the patient is holding the bite-fork, the U-shaped bar with the pointers upright is guided in position on the stem of the mouthpiece and tightened to it by means of the thumbscrew (Fig. 1*F*). While in this position the pointers are adjusted to touch the previously marked orbital and ear points on the patient's face and firmly secured by tightening the screws. The face bow together with the bite plate is now removed from the mouth. (Fig. 2.)

Transfer-Plate.—(Fig. 3.) The second instrument consists of a plate (Fig. 3*A*) of steel attached at the center, by means of a ball-and-socket joint (Fig. 3*B*), to a metal arm with a square hole (Fig. 3*C*) which fits on the center post of the model former (Fig. 3*D*). This metal arm can be fastened to the post by means of a setscrew (Fig. 3*E*). The transfer-plate can be set and

Clinic given at the meeting of the New York Society of Orthodontists, Nov. 16, 1937.

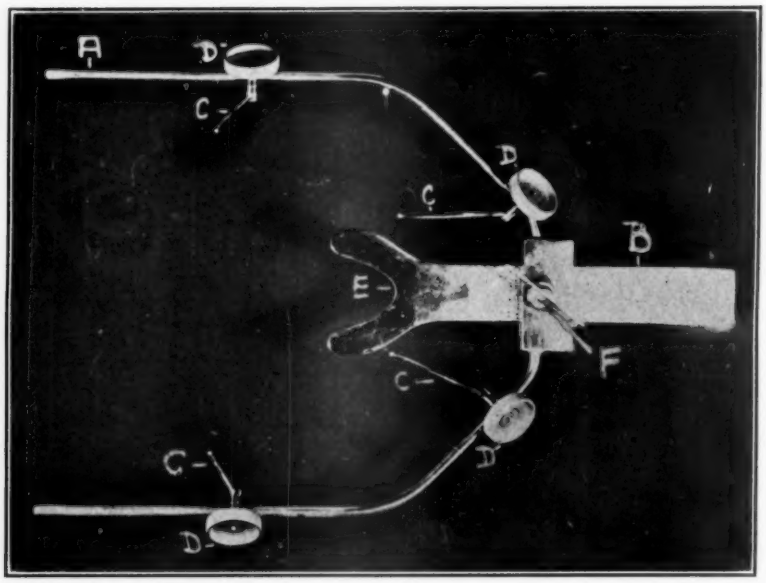

Fig. 1.—Face bow: *A*, U-shaped bar; *B*, mouthpiece; *C*, pointers; *D*, setscrews; *E*, forked part mouthpiece; *F*, thumbscrew for mouthpiece.

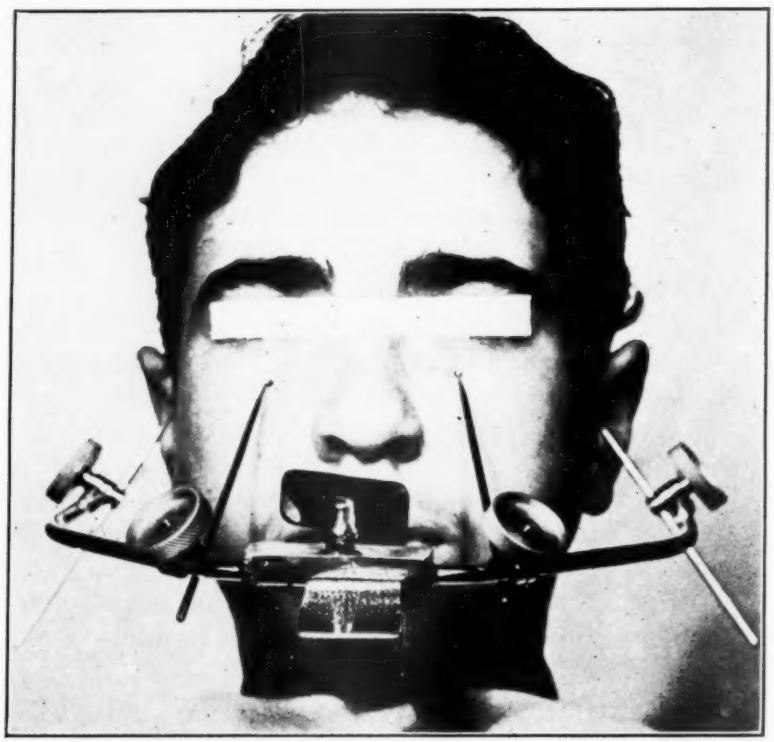

Fig. 2.—Face bow adjusted to patient's face.

fastened at any angle to the base of the model former by means of the ball-and-socket joint. Set into each end of the transfer-plate is a sleeve (Fig. 3*F*), slit through its full length on the outside, where two flanges with a setscrew (Fig. 3*G*) close the lumen of each tube. These tubular sleeves receive the ends of the U-shaped bar of the face bow.

Purpose of the transfer-plate is to receive the face bow and transfer its four pointers to the platform of the model former so that the platform automatically becomes the eye-ear plane. This is done in the following manner: After the face bow with the bite wax has been removed from the patient's mouth, the upper model, prepared without a base from a previous impression, is placed with the teeth into the imprint of the occlusal surfaces on the bite wax and fastened

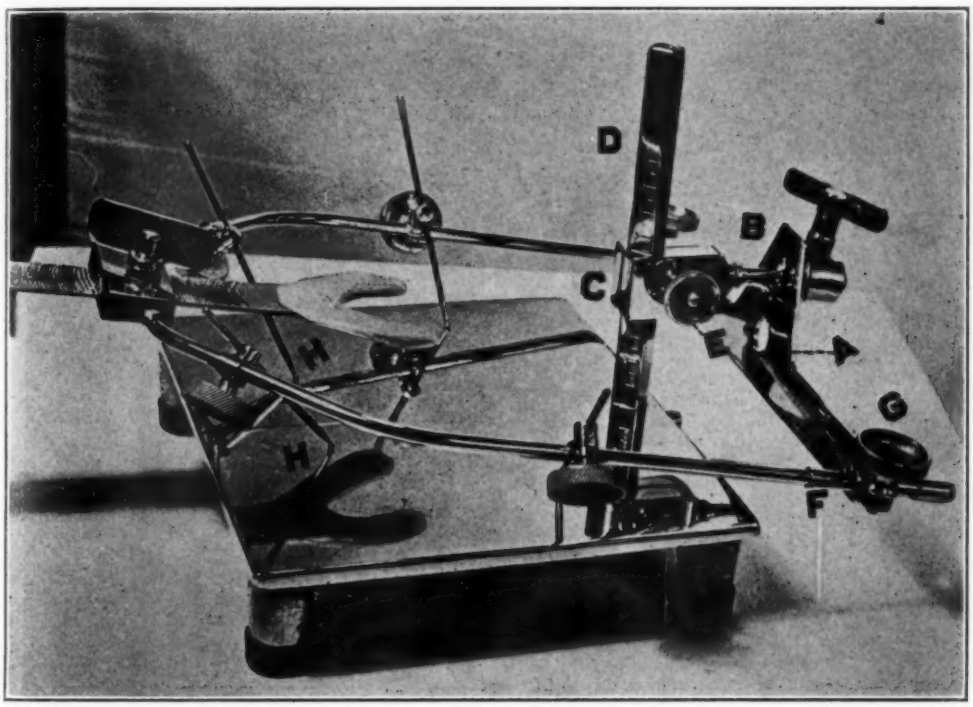

Fig. 3.—*A*, Transfer-plate; *B*, ball-and-socket joint; *C*, metal arm; *D*, center post graduated in centimeters and millimeters; *E*, setscrew for metal arm; *F*, slit sleeve to receive face bow; *G*, setscrew of sleeve; *H*, orbital pointers of face bow touching platform of model former.

to it by means of sticky wax (Fig. 4*A*). The face bow carrying the upper model is now fastened to the transfer-plate of the model former by inserting the ends of the U-shaped bar into the tubular sleeves of the transfer-plate and the setscrews are tightened (Fig. 4*B*). By loosening the ball-and-socket joint (Fig. 4*C*) and by raising or lowering the transfer-plate by means of the arm (Fig. 4*D*), the four pointers (Fig. 4*E*) on the face bow can be made to touch the platform of the model former, in which position the transfer-plate is tightened to the center post and the ball-and-socket joint made rigid. At this time a reading is taken on the center post, to register the distance of the arm of the transfer-plate from the platform. The platform of the model former when touching these four points is thus made to coincide with the eye-ear plane of the patient. The teeth

of the upper model bear the same relationship to the surface of the platform as the teeth of the patient bear to the eye-ear plane.

Marking the Line Where the Orbital Plane Meets the Eye-Ear Plane.—Where the two orbital pointers meet the platform (Fig. 3*H*), two points are marked with a black China-marking pencil. The transfer-plate carrying the face bow and model can now be removed off the square post and the pointers turned up horizontal with the face bow (Fig. 5*A*). With the China-marking pencil a line uniting the previously marked orbital points is drawn on the platform. This line is the intersection of the orbital and eye-ear planes. The upper ring of the model former is now placed over the marked line on the platform Fig. 5*B*) and filled with soft plaster. The transfer-plate carrying the face bow,

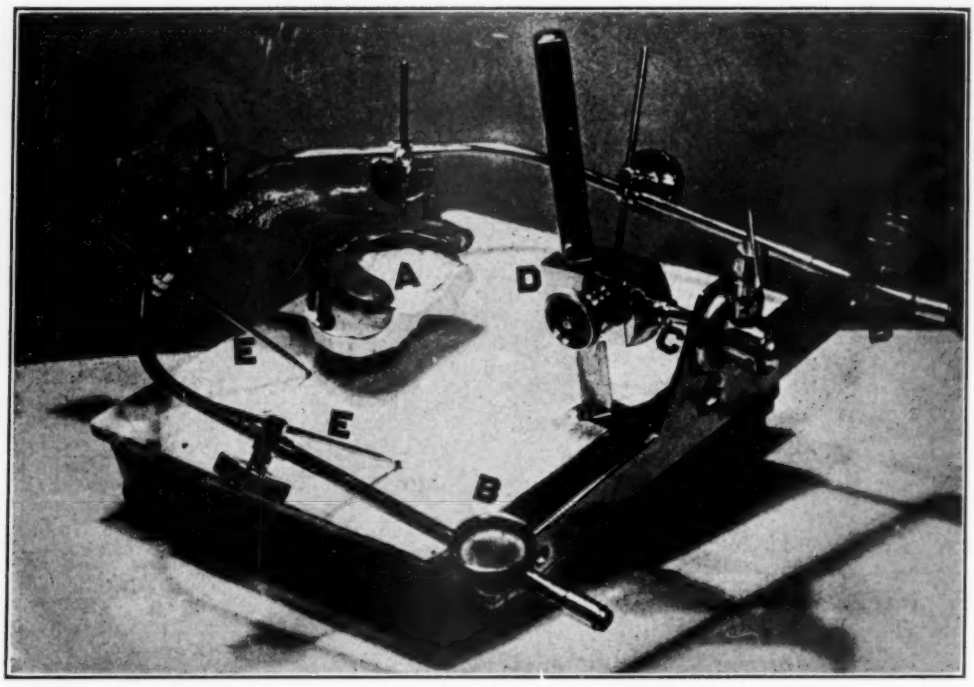

Fig. 4.—*A*, Model attached to bite-fork; *B*, sleeves and setscrews holding the face bow; *C*, ball-and-socket joint; *D*, metal arm carrying the transfer-plate; *E*, pointers of face bow touching platform of model former.

with the model fastened to the bite wax, is replaced on the square post and guided down until the model is set into the soft plaster in the ring (Fig. 5*C*). By tightening its setscrew, the transfer-plate is fastened to the model former. At this time the distance of the arm to the base is again recorded. The difference between the first and second reading is the length by which the distance from the eye-ear plane to the occlusal plane has been reduced in the model. After the plaster has hardened, the transfer-plate and face bow with wax are removed from the model former. The model is then released from the model former, in the same way as the plain models described later. This upper model has its base identical with or parallel to the eye-ear plane, and on this base is a line representing the orbital plane, transferred to it from the line marked on the

platform. The lower model is now completed, by using the model former in the manner described when only the plain models are formed. (See Figs. 3, 4, 5.)

Model Former Proper.—The third instrument (Fig. 6) consists of the following parts:

(A) A platform or base on four legs of cast iron with a machined flat surface.

(B) A steel square center post, graduated in centimeters and millimeters, fits into a hole in the middle of the back part of the platform. When inserted the post is perpendicular to the platform and is secured firmly by means of a setscrew in the posterior part of the base.

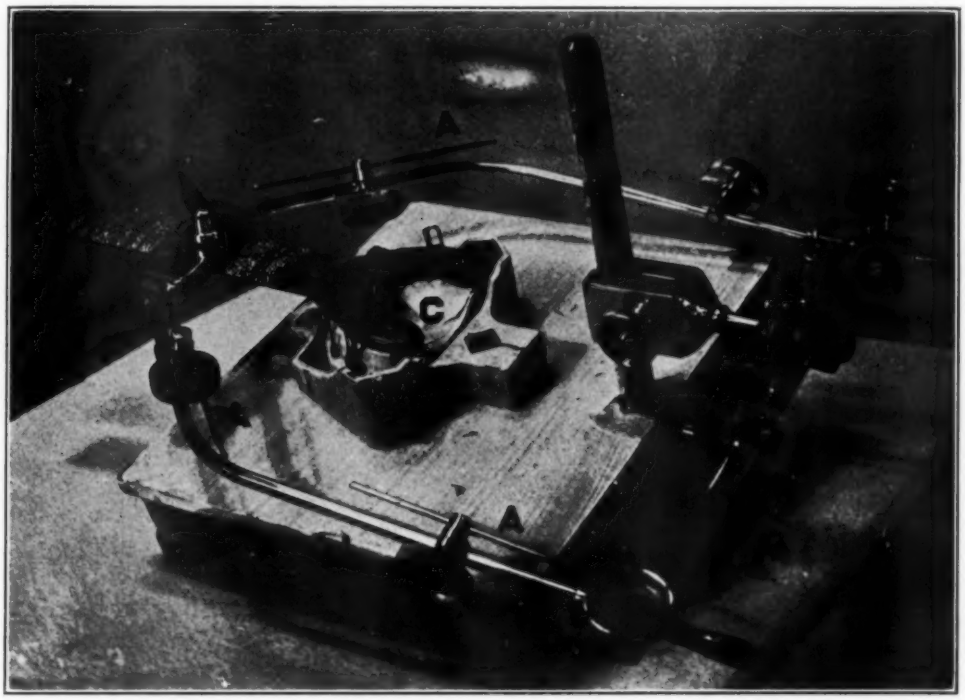

Fig. 5.—*A*, Pointers of face bow turned up horizontal with the U-shaped bar; *B*, upper ring of model former over marked orbital line on the platform; *C*, cast lowered into the ring.

(C) Two metal rings; one upper and one lower. These rings are machined so that they lie flat on the platform. The inside shape of these rings is the shape of the finished base of the model. The rings are made of one piece, split in front where they end in two flanges, held tightly together by means of a setscrew. When this setscrew is loosened, the rings spring sufficiently open to free the enclosed plaster models. Posteriorly the rings have metal extensions with machined square holes, which fit on the square post and by means of a screw can be fastened to it at any distance from the base.

(D) A levelling plate which consists of a flat plate attached to a squared sleeve which also fits the square post and can be fastened at any level on it, by means of a spring controlled by hand. When this spring is pulled out partly, the plate slides easily on the bar; releasing the spring fastens it to the bar. This is used to guide the model into the rings.

How to Use It.—The impressions are poured in plaster or stone and are filled with very little excess over the anatomical portion. After the models are separated and obtained, the portion just below the teeth is protected by means of adhesive tape. The ring of the upper model is placed on the platform of the model former, by sliding it down the square post. It is then secured in its proper position by tightening the posterior screw. On the platform is a line with which the split median line of the ring coincides. After the height of the finished model is decided on the plaster is mixed and placed into the ring. The upper model is now placed lightly on this plaster, with the median line of the model corresponding to the marked line on the platform. The levelling plate is now placed on the square post and, by pulling the spring, is pressed down

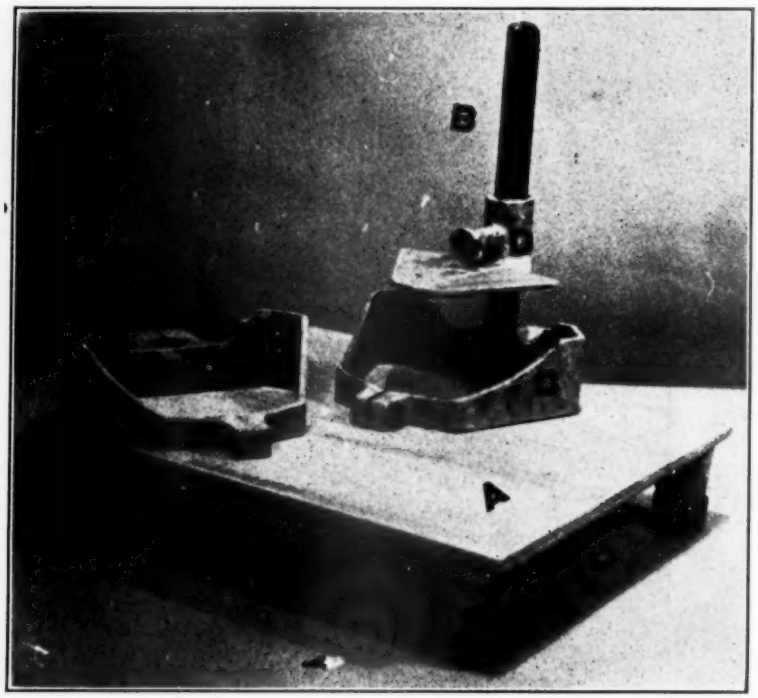

Fig. 6.—Model former: *A*, platform; *B*, square post graduated in centimeters and millimeters; *C*, metal rings; *D*, levelling plate.

until it reaches the marking on the graduated bar, which corresponds to the predetermined height. This plate presses upon the occlusal surfaces of the teeth, and the model is set into the soft plaster. Releasing the spring fastens the levelling plate at the predetermined height on the bar, and the plaster is allowed to set. If any imperfections exist, they can be corrected while the plaster is still soft either by adding or by taking away some of the plaster. After the plaster has set sufficiently, the levelling plate is removed, the posterior setscrew of the ring is loosened, and the ring and model are lifted off the post. The anterior setscrew of the ring is now loosened. This causes the ring to spring sufficiently open to release the plaster model. All that is necessary to finish this upper model is to trim away the excess plaster at the union of the anatomical portion with the art portion of the model, which is done by hand with a knife.

The upper model is replaced in its ring and secured by tightening the screw in front. The lower model is now occluded with the upper model, and the two are held together with sticky wax. In order to prevent the sticky wax from

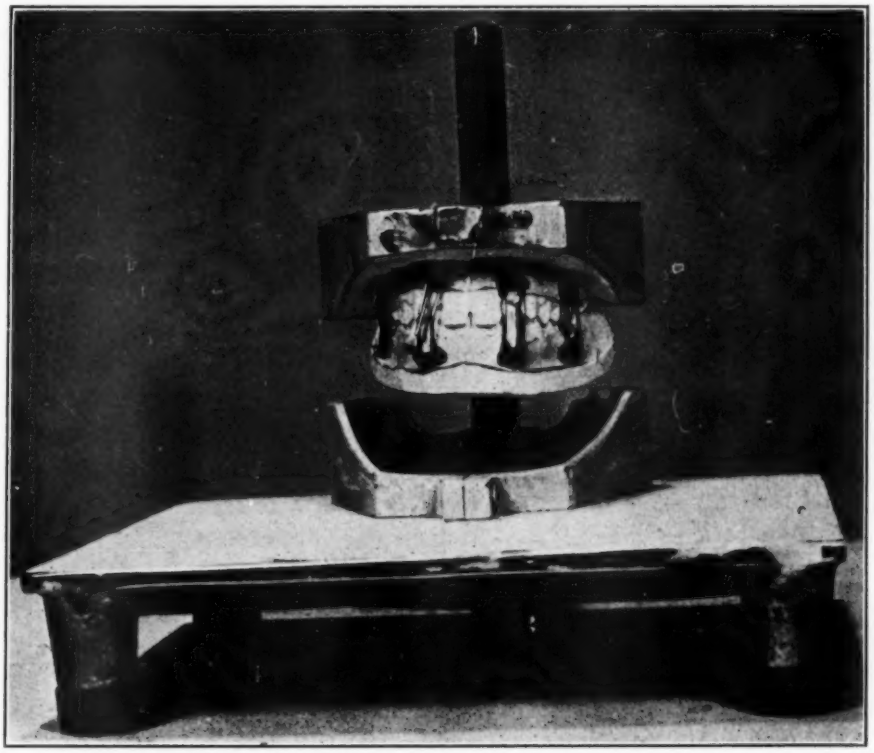

Fig. 7.—Model former with lower cast fastened to the upper cast, being lowered into plaster in the lower ring.

Fig. 8.—Finished upper and lower casts in model former.

staining the model, it is advisable not to remove the adhesive tape from the upper model until the lower model is completed; this allows the placing of the sticky wax on the adhesive tape instead of on the plaster. The lower ring is

placed over the bar onto the platform and tightened. The height of the lower model is decided upon and added to the known height of the upper. The combined height is then noticed on the graduated bar. The lower ring is now filled with plaster, and the upper ring with its model and lower model attached to it, is carried onto the square bar with the lower model downward (Fig. 7). This is then lowered into the soft plaster until the upper surface of the upper model reaches the predetermined reading on the graduated bar. At this position the upper ring is tightened to the bar and thus prevents the lower model from sinking any farther into the plaster than desired. Any addition of the soft

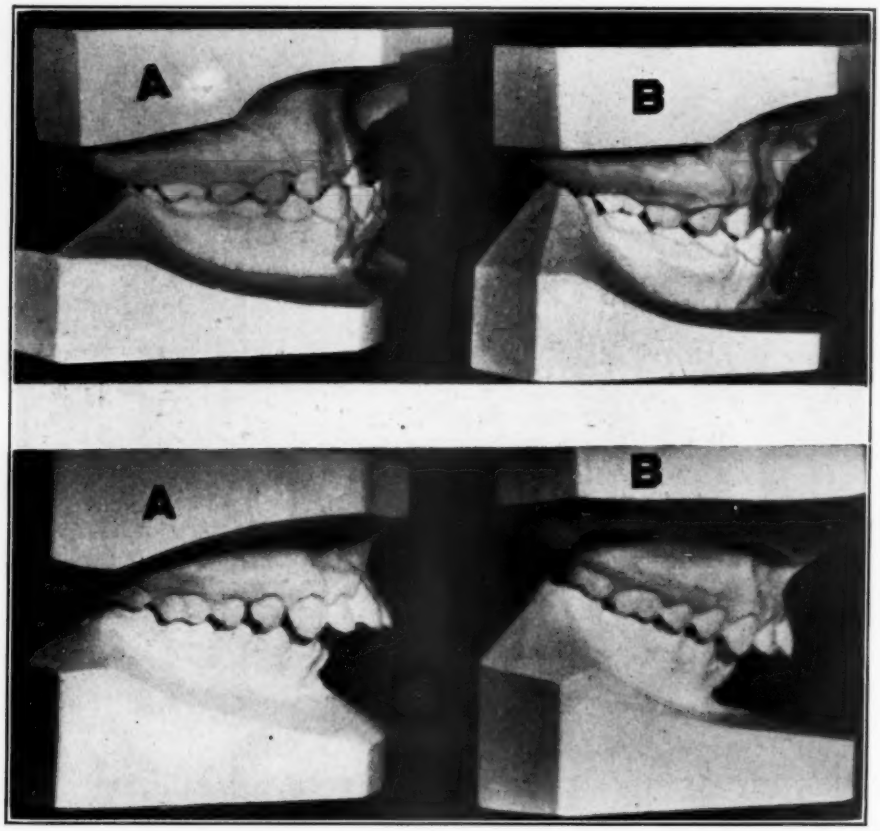

Fig. 9.—Finished casts. *A*, Casts made without the use of the face bow; *B*, casts made with the use of the face bow.

plaster or smoothing of plaster around the lower model can now be made; the model being accessible from all sides. After the plaster has set, the models are released by loosening the screws.

Fig. 8 shows the finished upper and lower models in the model former.

Fig. 9 shows some of the finished models made with the model former. The models *A* were made without the use of the face bow and the models *B* with the use of the face bow.

Fig. 10 shows front and side views of four models made by this technique. The face bow and model former were used. Model E.S. 21 is a duplicate of model

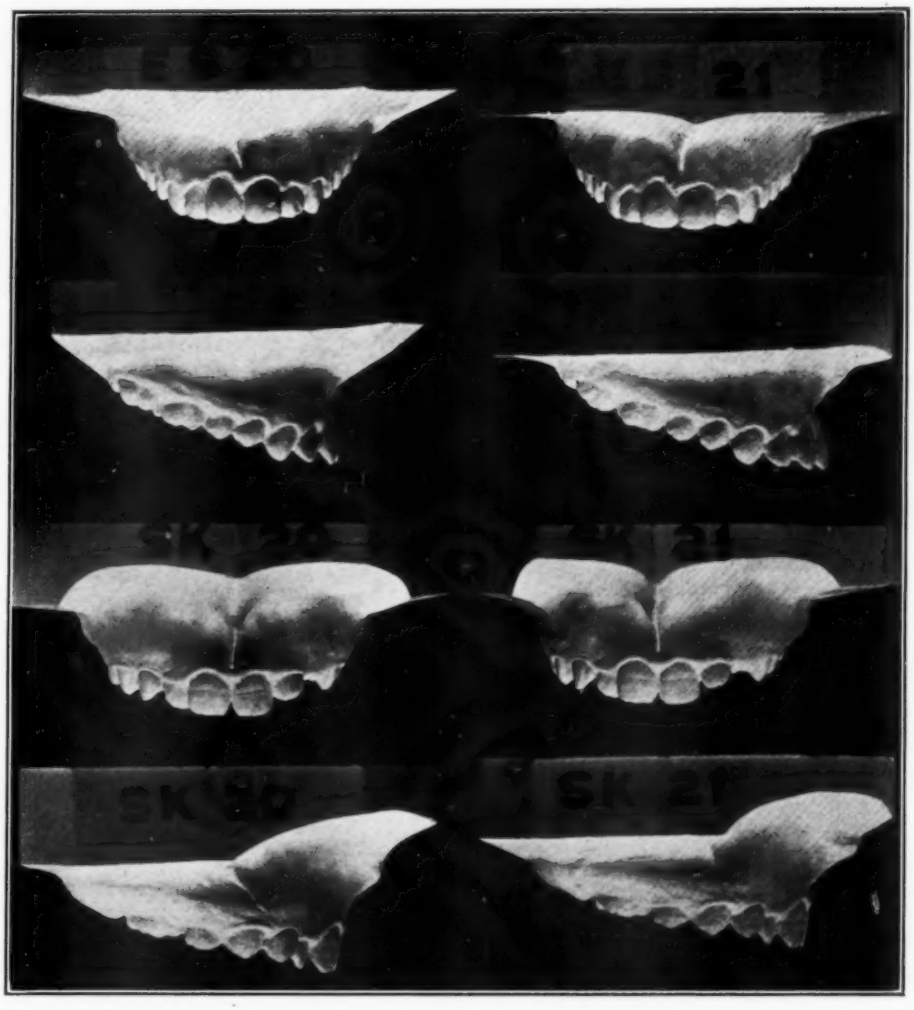

Fig. 10.—Casts E. S. 20 and E. S. 21 were made from impressions taken of the same mouth at different times. Same for models S.K. 20 and S.K. 21.

TABLE I

Right	MODEL E.S. 20 MM.	MODEL E.S. 21 MM.		MODEL E.S. 20 MM.	MODEL E.S. 21 MM.
Posterior plane to----6	20.0	22.5	Eye-ear plane to----6	29.8	30.8
Posterior plane to----3	42.5	45.0	Eye-ear plane to----3	37.8	39.1
Posterior plane to----1	53.0	55.5	Eye-ear plane to----1	39.2	40.5
Left					
Posterior plane to----6	21.0	25.0	Eye-ear plane to----6	30.0	33.4
Posterior plane to----3	43.5	47.5	Eye-ear plane to----3	37.7	40.3
Posterior plane to----1	54.0	58.0	Eye-ear plane to----1	38.9	40.8

E.S. 20, and model S.K. 21 is a duplicate of model S.K. 20. The duplicate models were made from separate impressions taken ten days after the first impressions were taken. This necessitated the adjustment of the face bow at two different sittings for each case.

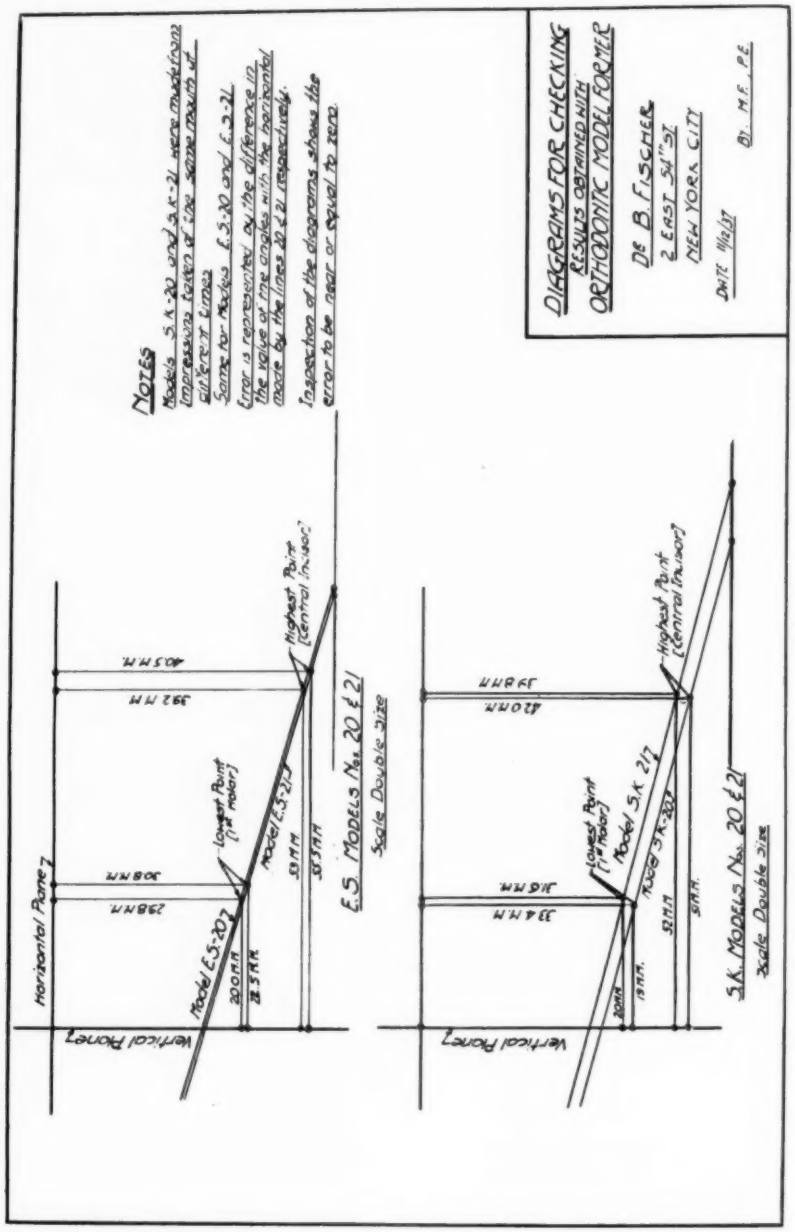
DIAGRAMS FOR CHECKING RESULTS OBTAINED WITH ORTHODONTIC MODEL FORMER
Dr. B. Fischer
2 East 54th St
New York City
Dr. Wright
Dr. M.F. Pf.
NOTES
Models S.K. 20 and S.K. 21 were made from impressions taken at the same month at different times.
Same for Models E.S. 20 and E.S. 21.
Error is represented by the difference in the value of the angles with the horizontal made by the lines 20 & 21 respectively.
Inspection of the diagrams shows the error to be near or equal to zero.
E.S. Models Nos. 20 & 21
Scale Double Size
S.K. Models Nos. 20 & 21
Scale Double Size
Horizontal Plane
Vertical Plane
Highest Point (Central Incisor)
Lowest Point (1st Molar)
Model E.S. 20
Model E.S. 21
Model S.K. 20
Model S.K. 21
405 MM
392 MM
308 MM
298 MM
200 MM
85 MM
50 MM
420 MM
334 MM
314 MM
100 MM
50 MM

Fig. 11.—Diagrams made from casts shown in Fig. 10. Error is represented by the difference in the value of the angles with the horizontal made by the lines 20 and 21 respectively. Inspection of the diagrams shows the error to be near or equal to zero.

Tables I and II show the perpendicular distance in millimeters of the highest and lowest occlusal points of the teeth from the horizontal (base of model) and a posterior perpendicular vertical plane. The values of these tables were taken from the models shown in Fig. 10 and were used in making the diagrams shown in Fig. 11. The highest and lowest points of the right side only were used.

TABLE II

Right	MODEL S.K. 20 MM.	MODEL S.K. 21 MM.		MODEL S.K. 20 MM.	MODEL S.K. 21 MM.
Posterior plane to----6	19.0	20.0	Eye-ear plane to----6	33.4	31.6
Posterior plane to----3	45.0	46.0	Eye-ear plane to----3	39.1	37.0
Posterior plane to----1	51.0	52.0	Eye-ear plane to----1	42.0	38.8
Left					
Posterior plane to----6	17.5	18.0	Eye-ear plane to----6	33.2	32.0
Posterior plane to----3			Eye-ear plane to----3		
Posterior plane to----1	51.0	51.5	Eye-ear plane to----1	42.2	40.2

The diagrams (Fig. 11) made from the models in Fig. 10 show the angles formed by the occlusal plane and eye-ear plane to be identical for both models in each case. The error is negligible.

Those who still like to trim their models by hand can, by following this technique, have their models related to the eye-ear and orbital planes. The technique is similar to the one described except that the plaster is built up to the model directly on the platform of the model former without the use of the rings. This automatically makes the base of the model identical with the eye-ear plane. The orbital plane is then transferred to the model in the manner described. The sides of the model are then trimmed by hand.

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2 EAST FIFTY-FOURTH STREET

THE LABIAL ARCH

Its Forms, Progress, and Adaptability

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MODERN orthodontics has worked out its mechanical appliances to conform to the belief that bone development can be stimulated by mechanical devices.

Sir Arbuthnot Lane, Bart, F.R.C.S., states the fundamental law, that "The skeleton represents the crystallized lines of force. When force is exerted in the same direction, it is laid down as compact tissue. When in various directions, as cancellous tissue." This theory would indicate a belief that our entire skeleton has been influenced by mechanical force and stimulation. If pressure has played such an important part in the development of the entire skeleton, it can be assumed that a great amount of development could be accomplished by the proper application of force in a limited area. The problem of modern orthodontics is the proper application of mechanical force in the upper and lower jaws, and its corrective effect on contiguous structures.

HISTORY

In a short presentation as this one is, it is not feasible to present either an exhaustive historical review or a complete exposition of all phases of the labial arch with its numerous transitions and refinements, but rather some of my own observations in handling this mechanism in the fifteen years of my orthodontic experience.

Historical references indicate that Fauchard in 1728 gave, in the first extensive treatise on purely dental subjects, the earliest form of orthodontic appliances, the "bandelette," which is recognized today as the expansion arch. While it undoubtedly antedates Fauchard, who does not claim originality, the mechanical principles he laid down then, though crude, are parallel to those employed today in contemporary orthodontics.

He recognized in 1723 that it was necessary to have sufficient resistance to an exercised pressure when it was employed as a mechanical force through some form of apparatus. His device, "the band" as he named it, eventually developed into the expansion arch. The latter, since its inception, has been modified a great number of times, and not always with improvement. But where refinements have manifested themselves, it was in a better control of the distribution of force, both in moving teeth and in securing greater stability of anchorage. This enhanced its efficiency greatly, and proved an appreciated comfort to the patient.

Presented to the American Board of Orthodontia.

Weinberger credits as the chief contributors to its modern evolution, Bourdet in 1757, Fox in 1803, Antoinne Delabarre in 1819, Schange in 1841, Harris 1850, Farrar in 1888, and Angle in 1889. Its introduction marks the most important step in the history of regulating appliances. As he relates, "in its early forms, this arch was very crude and inefficient. Its attachment to the anterior teeth, by means of fibrous ligatures, was very unstable in comparison with its present almost ideal form of attachment, by means of the easily adjusted, secure, anchor bands, with their tubular sheaths firmly soldered to the band at the most convenient point. By this means, the firmest attachment of the arch to the teeth is secured, and the strongest attainable anchorage—stationary anchorage—gained."

The early forms of the arch, i.e., flat, square or half round, have been changed to the more compact, sanitary and elastic form, i.e., the round, and later to the flat oval.

At the turn of the present century, this type of appliance appeared with both ends threaded, and it was used for expansion.

It was from that fact that the name expansion arch was given to it. In the treatment of malocclusions it was often found necessary to contract the dental arch; and with the advent of intermaxillary anchorage and elastics, teeth were also moved forward or backward with the expansion arch. Lischer therefore suggested that the appliance be called the "alignment wire," as it was more descriptive and less confusing. In instances in which the arch had to be contracted with an expansion wire, it would be a contradiction in terms; whereas if the arch was contracted with an alignment wire, the description was more accurate and was more readily understood.

The present form of the labial arch can be traced to the plain arch of Angle, which was a part of his device for the treatment of protruding maxillary teeth. Case employed forms of the alignment wire in the construction of this contouring appliance. Ainsworth likewise used another form in his appliance known as the Ainsworth appliance. The Ainsworth appliance, as originally made, was limited to the expansion of the teeth and was not adapted to the various tooth movements as was the Angle mechanism. In the plain arch, we have a long spring, which is a useful appliance for exerting force upon both sides of the arch by means of reciprocal anchorage. The results this treatment yielded, however, were not ideal. In the treatment of malocclusion, in Class I cases (Angle) with its subdivisions, and Class II or distoclusion with subdivision of retruding anterior teeth, or in Class III cases, various combinations were used, but with little success. By threading the ends of the plain round arch and putting on the nut, an appliance was achieved that combined the force of the spring lever and the jackscrew. With the advent of intermaxillary anchorage, results were a great deal better than ever before. With the proper adjustment of the arch and the addition of a few devices for the movements of roots of teeth, the results are limited only by the ability and the imagination of the operator.

The expansion arch, or alignment wire, as designed by Angle, possesses a patented nut with a friction sleeve, which slips in the end of the tube soldered to the molar band. The round end of the nut fitting in the tube prevented

the cheeks from working the nut loose. In order to be most useful, the round end of the nut must fit in the tube closely.

MANIPULATION

In using the labial arch, one must be familiar with the various forms of anchorage in order to obtain the best results. It can be used with any of the three types of anchorage; namely, intramaxillary, intermaxillary, or extramaxillary anchorage. Any one of these may be simple, stationary or reciprocal. In the modern practice of orthodontics, however, extramaxillary anchorage with its occipital, facial or cervical support, has been used less frequently in routine treatment. Its appearance, bulk, and discomfort to the patient make it difficult to obtain proper cooperation. In adjusting the arch, we usually depend upon simple anchorage obtained from the molar teeth that have been fitted with bands. The tubes on the molar bands must be so placed and the sides of the arch so adjusted that the tube and the arch will be parallel with each other before the arch is placed in the tube. If this is not carefully done, the molars will be rotated by the spring in the arch. My experience, however, has shown that in a great number of cases it is necessary to rotate the first molar so that the mesial buccal cusp presents further buccally. If the molars are reenforced lingually by a soldered extension to include the first premolar, rotation of the first molar carries with it needed buccal expansion of this lateral segment. The sides of the arch lie close to the teeth, so as to avoid any irritation to the cheeks. In fitting the ready-made arch, one side is placed in the tube on the molar band, and its position noted. If it is too long, the nut is moved forward until the arch is adjusted to the proper size. If the end protrudes through the tube, this is cut off to avoid injury to the cheek. The arch is placed again in the tube on one side only, and adjusted closely to the teeth. A mark is made to note the canine position, and the arch is removed. A bend is made in the arch opposite the canine so that the anterior part of the arch can be properly adjusted. The opposite canine position is then noted and a bend made there. Proper adjustment of the nut and distal length of this side should then be made. It must lie parallel to the tube in a passive position. Both sides of the arch are tested in this manner separately.

If the arch wire is to be adjusted for a case that requires expansion, it is first adjusted to lie passively in the tube on both right and left sides, and the patient is permitted to wear it that way for a week, to become accustomed to the appliance before pressure is applied. When expansive pressure is to be added, the arch is removed from the tubes and the sides are bent out a little. It should not be more than 3 or 4 mm. from its original position. A useful plan is to record the original arch form on graph paper ruled to millimeter widths and the new force registered by comparison with the original arch form. The canine region very often requires a little wider adjustment. In replacing the arch, care must be taken that the sides are parallel in their buccal relation to the tubes. This refers to cases in which bilateral expansion is required. In cases of unilateral expansion, the passive side is first made stationary and the expansive pressure is then placed on the required side.

A useful alteration of the arch form was the placing of loops at strategic points in the arch which Dewey termed "loop regulating appliances." These had for their purpose the control of the arch through opening or closing the loop to increase or decrease the size of the arch, and thereby eliminate the use of the screw on standard forms of alignment wires. It had another advantage of having a reserve length of material when this was required in reshaping the arch after preliminary treatment was completed.

Lourie of Chicago introduced an innovation to the standard arch form in presenting the high labial arch. This was the regular labial arch adjusted through a vertical right angle bend so that the labial sector lay just under the labial fold. It was necessary, therefore, to solder small extension springs and spurs for control of tooth movement, and had the decided advantage of making this appliance less conspicuous. The spurs were of smaller gauge than the body wire and allowed of greater elasticity than was heretofore applicable with this type of appliance. This made it possible to use pressure on individual teeth without disturbing the labial arch. These spring extensions were used to rotate teeth, to depress or elongate teeth, or for the bodily movement of teeth. Where this latter gross movement is desired, the tooth is banded and a small gauge tube of 0.020 inch is soldered to the band. The direction of the tube, whether it is parallel or perpendicular, depends on the contemplated movement. The spring is shaped like the letter U. The extension part is fitted in the tube, and by means of opening or closing the loop, tooth movement is controlled. For rotation, the extension spring is shaped like the letter J, which makes possible a two point contact on the labial surface of the tooth and allows for rotation. If a tooth is to be elongated, the tooth is banded and a small spur with bracket effect is soldered to the band which holds the end of a long spring. The spring is given a downward pressure before being placed in the bracket spur. Extension springs or long spurs used on the maxillary anterior teeth are the simplest ones. They are vertical, tapering toward the incisor, allowing of considerable elasticity, and prevent displacement of the arch. This spring may be used to move a tooth lingually by pressure, or labially by a pull force, if it is manipulated in conjunction with a ligature. When this action is desired, the end of the spring may be a knob, eyelet, or incisal hook.

ADJUNCTS

The labial arch in its elemental form of a single wire placed on the outside surface of the teeth is incapable of a variety of movements without auxiliary attachments. Ligatures were a natural necessary aid to augment some of these desired movements. The early brass ligatures served a useful purpose, but their unyielding form after the tooth moved slightly in response to pressure suggested another type of ligature which proved quite popular. This was the Japanese grass line ligature that contracted after being moistened, and thus followed a tooth in its direction of pressure and had the additional advantage of not causing discoloration to the tooth by oxidation as the brass ligature did. The swollen grass line, however, often presented an unsightly bulk through its ability to absorb foods, and odors made it objectionable for

universal practice. A third variety, of rubber, was limited because of its intense continuous force exerted. The fourth variety, of stainless steel, is the one most universally used today. Its wide usage and different applications have made this wire ligature available in a wide variety of sizes as regards its thickness; 0.008 inch; 0.010 inch; and 0.012 inch are the most popular sizes. It fulfills the requirements of a good wire in that it is readily adaptable, easily manipulated, and sufficiently strong that it will not stretch when stress is applied to it. It is made of a bland metal, is easily tolerated by the tissues and, as its name implies, is stainless, thus obviating discoloration to the tooth through oxidation.

The method of application of the ligatures is important for the successful manipulation of the arch. Ligatures should be twisted consistently in one direction to the right, just as a nut. This is done so that when a ligature is to be tightened or loosened, the operator instinctively turns to the right or left without having to determine which way the ligature was turned originally. Many varieties of tooth movement, such as rotation, elongation and depression, movement of a tooth forward, laterally or obliquely as in shifting the median line, can be accomplished by ligatures. It is often employed to reenforce the anchorage by adding the additional resistance of other teeth by ligating them to the alignment wire and also to lock the arch to the attachment.

Elongating a tooth with a ligature is accomplished by encircling the cervical region of the tooth, first twisting the wire on the labial presentation several turns, then attaching the ends of the ligatures, one below and one above the labial arch and completing the tension by twisting the wire to institute incisal pressure to lengthen the position of the tooth in the arch.

Elongation with grass line has been attempted by wrapping the strands of the silk ligature several times cervically, then attaching it to the labial arch. This procedure, however, is very painful and may cause considerable damage to the gum tissue and paradentium through its intense and violent action. Though its effects are quite positive, it is not to be recommended.

Rotating a tooth with metal ligature wire may be accomplished without a band only if it is a simple rotation. This is done by passing both ends of a ligature wire above and below the labial arch mesially and both ends of the wire brought around lingually to the distal. The wires emerge with one end above and one below the arch, and then are twisted and tightened. The process is reversed, however, where the mesial end is to be rotated to the arch. A slight variant of this is employed with the grass line ligature, in that a noose is placed around the crown of the tooth gingivally and depending on the frictional attachment to the tooth on one side, the grass line is brought around the lingual, coming out interproximally to the labial wire and ligated. The direction of rotation is toward the two ends which are ligated to the labial arch. This is effective if the ligature does not slip.

The more positive method of rotating a tooth with the labial arch is accomplished through banding the tooth and soldering a hook or eyelet lingually and ligating in the direction to be rotated. A very convenient form of overcoming the annoyance of the ligature slipping from the tooth is an original attachment, as far as I know, which I have employed in my practice

for the last fourteen years. It is a double hook in the shape of handle bars that is soldered to the lingual surface of the band, gingivally. This second part of the hook is used to engage the ligature and thus prevent the wire from slipping off the tooth. (Fig. 1.) It is particularly adaptable in very short teeth, or where there is no contact point, through mutilation, positional placement, or eruptive development. It insures continued placement and secure attachment of the ligature.

Depression can also be accomplished with ligatures and a labial arch by ligating a tooth as described above, to rotate, with metal ligatures. The important difference, however, is to see that the pressure is exerted on the tooth in the region of the cingulum, as it traverses the tooth from one approximal surface to the other. It is to be employed, therefore, only on anterior teeth.

A ligature in the form of the letter eight is efficacious in closing space between two teeth where the crowns are separated wider than the apices, or to act as retention in holding two teeth that have been moved together in this manner. Its reciprocal action is convenient and effective.

This principle can be extended to include larger groups of teeth. In cases where the maxillary anterior teeth are lingual to the mandibular and are being

Fig. 1.

moved labially, until the bite is jumped, considerable pressure often is exerted against the mandibular incisors unless a reenforcement for the mandibular anterior teeth is introduced. This can be accomplished simply by looping a reenforcing wire interproximally on alternate teeth in extension of the principle mentioned, so that the strain is reduced.

When attempting to shift teeth to the median line with the labial arch, it is necessary to solder spurs in slight offset to the vertical axis of the teeth in question. The spurs may be a drop of solder or the half loop spur, which is made by bending a fine gauge round wire to half encircle the arch on the surface that faces the teeth, and soldering. This leaves the labial presentation against the teeth free of sharp ends to annoy the lip, and still maintains full efficiency of the spur. The ligature is placed by first encircling the arch to engage the spur, which is placed in the direction the teeth are to be moved, then encircling the tooth and ligating. The tooth tied in this oblique direction is moved obliquely to the median line.

Perhaps the nicest refinement in the lock control of the labial arch was the substitution of a loop spring at the point it enters the buccal tube, to replace the screw end and nut of the earlier form. This changed the control of this mechanism from the severe jackscrew principle, to a light, resilient spring force that is more in keeping with the biologic concept of treatment

in modern orthodontics. The spring is soldered at one end, arched in a semicircle and wound in a circling eyelet around the arch so that the eyelet is in close approximation with the buccal tube. The labial arch can be contracted or lengthened by closing or opening this loop spring and thus convey the delicate spring pressure to the anterior teeth that are ligated to the arch.

The widespread and extensive use of combinations of the labial arch in conjunction with various forms of attachments for its reception, requires some passing reference. These various systems have different types of attachments to accommodate small gauge round wires, to powerful flat oblong widths. They involve a very profound study for the understanding and manipulation of the appliance that would require too extensive an account in a presentation such as this is, if a comprehensive report were to be given. This includes the various types and modifications of the Angle mechanism and its host of imitative attachments. The control of the labial arch is transmitted to each tooth through individual banding and attachments that are soldered to the band.

Another valuable use in which the labial arch may be employed, is the combination of this mechanism with coil springs. This adjunct is peculiarly adaptable and efficient, and affords a positive, constant, yet very delicate pressure. While it is readily employed in many situations, it is not wholly applicable in all conditions we are called upon to treat. But it suggests a variety of uses in a great many cases. Recently the precious metal that was used to make these springs has been replaced with varieties of chrome alloy. Because of the extreme spring potentialities of this newer metal, however, finer gauges must be employed. Originally, they were 0.010 inch in diameter and were coiled to fit 0.040 wire, but the greater potential force of stainless steel permits the use of 0.008 with equally efficient results. The stainless steel cannot be soldered readily. They exercise their pressures against the resistance of a small lug soldered to the labial arch. Additional anchorage must be secured, however, through ligation or other attachment of the teeth not involved in the area. The coil should be adjusted with a compression of not more than 3 mm., and the most satisfactory results may be most often accomplished by the use of only 2 mm. compression. This gentle pressure will produce body movement of the teeth, and if a greater force than the one recommended is employed, the appliance will be displaced, and tipping of the teeth will occur. This is most useful in the distal movement of molars. Recently, finer gauges and smaller coils have been introduced for rotation of teeth, with encouraging reactions.

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REPORT AND RECOMMENDATION OF THE ECONOMIC COMMITTEE OF THE MISSOURI STATE DENTAL ASSOCIATION*

SOME form of change in the delivery of medical care is perhaps inevitable. Therefore, the dental profession, too, is at a crossroad. Despite the fact that the problems of the two professions differ materially, the dental profession will probably be carried along as an accessory to medical care, unless a public-satisfying alternative is in operation.

The decision to devise that alternative should not be deferred until probabilities become actualities. If, on the other hand, the profession has decided that no acceptable alternative can be devised, well and good, then it should at least offer conclusive proof to that effect or resign itself to consequences. It will not suffice to sit blithely aloof on a pinnacle of professional conservatism and retort, "It can't be done! It won't work!" in answer to suggested radical changes. The proof must be forthcoming, but until we have exhausted all possibilities that proof cannot be honestly tendered.

In the ultimate, the first responsibility of a profession is public welfare. The self-interest of a profession should enter the consideration only as a vehicle. A profession must, at least in this day of social unrest, think impersonally if it hopes to hold public confidence, and through that confidence retain its autonomy. After all, the *public itself* reserves the prerogative to think subjectively.

Adverse economic conditions and the indifference of the people notwithstanding, the profession is answerable for end results. Particularly is this true if, as now is the case, the profession holds the privilege of self-administration and cries, "Hands off!" to those who would interfere. Rightly or wrongly, that the profession's accomplishments are today challenged is obvious to all who read, listen, and think. Its failure to devise a plan through which the low income and indigent groups may be systematically served has invited external interference. That many practitioners now serve such persons on a basis of little or no compensation is apparently no answer to those who advocate remedial measures.

In the ultimate, our duty is to serve the people. Whether or not, in our opinion, the mechanism we have set up is adequate, we are forced to admit that the low income groups are not receiving proper dental attention. That fact alone, irrespective of other considerations, should stimulate us to some action.

Analyzing the problem from an impersonal viewpoint, have we exhausted every possibility to place the care of the underprivileged on a systematic and all-inclusive basis? Let us examine one possibility. If the profession completely laid aside its self-interest, what course of action would it follow? Only one; namely, it would open its arms and announce, "Here we are, come and be served, every man, woman and child, regardless of your social or financial status; the profession stands ready to serve you on any terms you can meet." *Exactly that is the essence of this report and recommendation.*

Such action would be no departure, no radicalism, no social revolution, but rather would constitute true professionalism. After all, such policy, which is an essential difference between a profession and a business, prevails today in a measure, but not on an organized or systematic basis. Such action would (1) offer proof of our sincerity; (2) provide a testing field to learn once and for always the exact part money plays or does not play in the matter of dental health; (3) perhaps avert the inauguration of radical experiments because its scope would be all-inclusive and therefore public acceptance should follow. In short, service would be available to all who wanted it; no taxpayers' money would be used; no profit-

*Because it is different, because it is new, and because it is the result of a tremendous amount of work, attention and thought, the "Report and Recommendation of the Economic Committee of the Missouri State Dental Association" is of interest to the dental profession. This report was officially adopted on May 9, 1938, and has also been officially adopted by the St. Louis Dental Society.

The editors of the JOURNAL feel that the JOURNAL'S readers will note with interest a somewhat new approach to the problems confronting the healing professions today as outlined in this report.

seeking middleman would wedge between patient and dentist; and, not least important, *the favorable educational effect would be tremendous.*

Such course of action is not too idealistic for practical application. Five years ago the members of the St. Louis Dental Society agreed to render service to the children of that city on just such terms. It is well known that the overture met with indifferent success. And why? In brief, lack of demand for the service and also faulty classification of the patient—both due in part to the fact that the initiative resided in, or was relegated to, the Board of Public Health; which, in turn, illustrates the fact that complete control must remain with the profession. It is pertinent that the St. Louis Dental Society had no agency of social survey under its control at that time. One factor, however, was apparently established; namely, the people did not want the service regardless of monetary consideration. *Do they want it now? Let us put the question to a test on a state-wide basis.* On a state-wide basis because the inauguration of health insurance legislation will probably, as in the case of the Social Security Act, depend upon acceptance by the individual state. Therefore, any plan advanced by the profession in the effort to keep politics out of health service must be state-wide in scope. However, since conditions differ in the various city and rural districts within the state, the details of operation must be subject to the judgment and under the control of the local practitioner. But obviously, under any state-wide plan, each district must subscribe to a common principle and purpose. Those who today advocate legislative interference in health matters generalize only and, with few exceptions, fail to support their generalities with a practical mode of procedure. In the opinion of the Economics Committee, any recommendation or plan to be worthy of consideration must be accompanied with sufficient explanatory detail to demonstrate the practicability factor. The Committee emphasizes, however, that the following eleven paragraphs of such detail are presented only as an explanatory measure or as a possible mode of procedure and not as fixed rule.

1. The dental profession acknowledges its professional obligation to the community and recognizes that many individuals are suffering from dental neglect due mainly, it is said, to financial limitation. The profession proposes to inaugurate a policy that may reduce such limitation as a determining factor.

2. It has the personnel, many of its members have the time, and each component district may either establish a qualified agency of social service to represent it, or call upon the public social agency for assistance. Such local agencies, if familiarized with the humanitarian purpose, could probably be relied upon to cooperate intelligently. (Fortunately the less populous communities render an adequate social or financial survey less difficult.)

3. Through well-directed publicity, full information can be conveyed to the public that those believing themselves unable to finance adequate dental care may *apply to the social agency representing the profession,* submit to a social investigation and receive treatment on such terms as may be deemed reasonable and fair by themselves and that agency.

4. The agency in this regard should be under the direct control of the participating group of dentists.

5. In order not to undermine the patient's evaluation of dental service, no payment should be designated a "fee" for a specific service, but *accepted only as a contribution to a general fund from which dental care for the low income person will be provided.*

6. It should, of course, remain the privilege of the dentist to conduct his practice with no interference or restriction whatever. Attention, however, is called to the fact that a social or financial survey *where indicated* may minimize unwarranted fee reduction and thereby help maintain the usual fee scale of each practitioner.

7. While the sum contributed by the patient may depend somewhat upon the type and extent of service needed, the primary factor should always be the patient's ability to pay. In all cases the patient shall receive reasonably adequate care in accordance to his class subject to the judgment of his dentist. Those individuals well able to pay prevailing fees should be advised to that effect and referred directly to their family dentist.

8. Free choice of dentist and patient should prevail; however, in the disposition of the indigent and very low income group, some control of choice may become necessary in order not to burden unduly any one practitioner.

9. The dentist of the patient's choice should always be consulted in advance regarding the patient's social status.

10. Participation by the dentist should be subject to his individual and voluntary agreement to cooperate. He should be privileged to agree or refuse to serve in any particular instance, and also privileged to withdraw his cooperation at any time.

11. The dentist should receive remuneration equal to the sum contributed by the patient less the cost of social survey if that survey entails expense.

Attention is called, particularly, to the young practitioner, that a low income patient may on occasion have a high income influence, and may also later become rehabilitated. The dentist serving those unable to contribute any sum may balance such cases against those from whom he receives remuneration, and thus for services rendered under the plan may consider himself remunerated on a group rather than on a unit basis.

Incidentally, many practitioners might be willing to render the usual high quality of service regardless of monetary consideration if such generosity remained their prerogative. However, once let legislation dictate a fixed fee, which probably would be inadequate, and unquestionably the quality of service would then deteriorate. This, in turn, would prove inimical to public welfare and also would retard technical progress.

It may be well to emphasize that if we unreservedly inaugurate this plan, which undoubtedly should receive wide publicity, many individuals may become dental health conscious and also conscious of the value of expeditious treatment who otherwise may not have given the subject a thought. Hence, the plan may prove in a material way quite advantageous to the dentist aside from his desire to render the people a real humanitarian service.

Any plan emanating from organized dentistry must of necessity be almost failure-proof, and a *complete answer*. In fact, an answer that could not possibly be challenged by legislative or cooperative bodies. Our plan must be practical, simple and sound in fundamentals that may endure; it must encourage public acceptance; it must avert technical relapse; it must involve no compulsion; it must permit free choice of dentist and patient; our plan must safeguard the autonomy of the profession; it must be dignified and uphold professional tradition; it must preclude the fixation of fees; it must be adaptable to changing economic conditions without undue reaction; it must be applicable to urban and rural communities; it must, in the ultimate, be equitable to both the patient and the dentist.

The proposal and the explanatory detail herein outlined seem to possess the above qualities. The principle is not an innovation. It is, in fact, nothing but a coordinated application of our traditional fee system wherein the dentist, through organized effort, is assisted in the uncertain and difficult task of determining a patient's exact social status. The Medical-Dental Service Bureau of St. Louis has employed that principle from time to time, particularly in orthodontic treatment, and very satisfactorily to both patient and orthodontist.

Given the enthusiastic and farsighted support of the individual members of the profession, the plan, while not a panacea, will undoubtedly extend the profession's usefulness, and at the same time may answer the charge that our traditional fee system is not adaptable to modern requirements. At least, through it the profession can demonstrate its willingness to cooperate with the public beyond the halfway mark. If the public should fail to respond, as those who have studied the problem may anticipate, well and good; then such evidence can be used in the effort to forestall external interference. The successful establishment of the plan will entail considerable self-sacrifice on the part of the profession; but as an alternative to what the legislator or the social experimenter may eventually force upon us and the public, it is at least worthy of trial and may prove to be seed well planted.

It may be well to emphasize that it is the intent of the Economics Committee that cooperation in the plan by the various districts of the state shall be the prerogative of each district. Furthermore, the mode of practical application shall be subject to the judgment of each district. It is also the intent of the Committee that participation by the individual member shall be subject to his individual and voluntary agreement to cooperate.

In principle and in detail the plan herein outlined is presented only as a basic structure to be altered and improved as study and experience in each district may indicate. This report and recommendation was approved in principle by the largest component district of

the state; namely, the St. Louis Dental Society, at a special meeting held April 25, 1938. For simplicity and coherence the salient points of the report are summarized in the following resolution which is respectfully submitted in the form of a motion for approval and adoption by this assembly of the Missouri State Dental Association.

RESOLUTION

WHEREAS, the members of the Missouri State Dental Association again acknowledge their professional obligation to the people of the state, and recognize that many individuals are still suffering from dental neglect due, it is thought, to financial limitation; and

WHEREAS, legislative or other external interference may, in the ultimate, prove inimical to public welfare and also retard professional progress; therefore be it

Resolved, That the members of the Missouri State Dental Association volunteer to render adequate dental treatment to the people of the state who now may be financially unable to secure such treatment, and on such terms as may be deemed reasonable and fair by the individual and the social agency under the control of the profession.

And further, that the officers of the Missouri State Dental Association be authorized to publish this resolution and the report of the Economic Committee to which the resolution is attached, in order that the various component districts of the state may have an opportunity to act voluntarily thereon.

Economic Committee, Missouri State Dental Association

L. M. Kallenbach
O. W. Brandhorst
O. A. Kelly
R. C. Mallory
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CYSTS OF THE JAWS

CASES OF UNUSUAL INTEREST

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CYSTS can be found in almost any part of the jaws. While they vary in structure and cause, their symptoms fundamentally are practically the same. In most instances very little pain is experienced.

The age of the patient matters little, as cysts are found in children as well as in adults. If they are not recognized early or are not properly treated, they may grow to an enormous size.

The pathology and the surgical procedure for the elimination of jaw cysts have been covered so thoroughly by many writers that it would be repetition to dwell in detail on these phases of the subject. Therefore, I shall present several interesting case histories which will emphasize the various important points.

The first two cases illustrate the commonest type of all jaw cysts, that is, the radicular or root cyst. This is caused by infection within the tooth.

CASE 1.—The patient, male, H. H., age 25 years, presented for examination August 11, 1937, complaining of a swelling above the central incisor region. He was obviously suffering considerable pain.

History.—He related that four years previously he had had the maxillary left lateral incisor removed, and some months later he had bridgework inserted, the left cuspid being used for abutment.

The patient, a young man of good physique, was seemingly in splendid condition. There was a noticeable swelling above the central incisor region. Upon palpation over this area, the typical parchmentlike crepitation was felt.

The roentgenograms disclosed a rarified area definitely outlined (Fig. 1).

Clinical Diagnosis.—Radicular cyst.

Operation.—On August 13, 1937, under novocain anesthesia, a vertical incision was made anterior to the left central incisor and along the gingiva. The mucoperiosteal flap was elevated from the bone. It was evident that some of the alveolar bone had been absorbed. The central incisor and the cyst in its entirety were removed. The cyst contained straw-colored fluid.

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Pathologic Examination.—(Microscopic) a mass of fibrous connective tissue with a lining of epithelium.

Final Diagnosis.—Radicular cyst.

Comment.—The patient made an uneventful recovery.

This case is the usual type, and is reported merely for comparison with the more interesting cases that are to follow.

Fig. 1.—Case 1. Simple radicular cyst in the incisor region.

Fig. 2. **Fig. 3.**

Fig. 2.—Case 2. Radicular cyst in the mandible, left side (before operation).
Fig. 3.—Left side several months after operation.

Case 2.—The patient, C. S., a white female, age 12 years, presented for examination, November 3, 1925.

History.—Two years previously, she had a swelling on the left mandible, with considerable pain. The ache gradually subsided in a few days.

There was a recurrence of the swelling and its attendant pain when she presented for examination. Upon palpating over the mandibular molar region, a distinct wavelike fluctuation could be elicited.

The roentgenograms revealed a cyst about the roots of the mandibular first molar (Fig. 2).

Clinical Diagnosis.—Radicular cyst.

Operation.—Under ether anesthesia, the cyst and the mandibular first molar were removed. The details of the operation were similar to those of Case 1.

Pathologic Examination.—Connective tissue lined with stratified epithelium.

Final Diagnosis.—Radicular cyst.

Comment.—It is just as important to x-ray children's teeth prior to their removal as it is in the case of adults. This case clearly demonstrates this fact. Merely removing the tooth in this case would not have been sufficient.

Cysts may many times be overlooked, because no symptoms are present. In the following case, while there were definite symptoms present in the maxilla, there was none in the mandible.

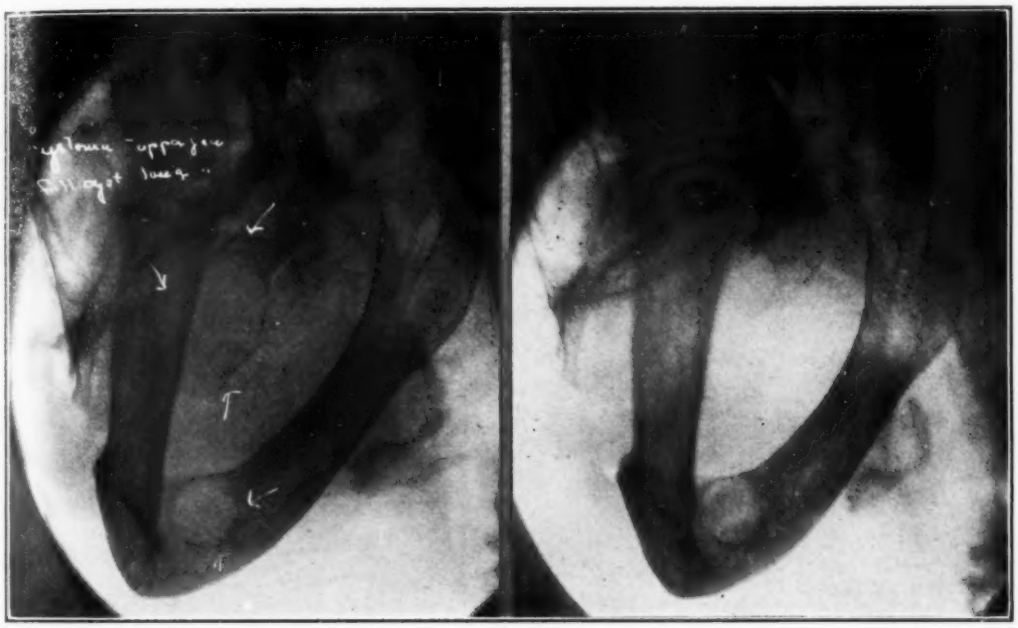

Fig. 4. Fig. 5.

Fig. 4.—Case 3. Follicular cyst in the maxilla and cyst in the right side of the mandible.
Fig. 5.—Right side several weeks after maxillary operation.

Case 3.—The patient, M. A., a white female, age 45 years, presented for examination, June 20, 1935.

History.—The patient related that eight weeks previously she had noticed a swelling in the right maxilla. She experienced no pain or soreness during this time. The patient had an edentulous mouth.

Extraorally there was a large swelling of the right cheek in the region of the maxillary sinus. By palpating intraorally over the distended tissue area, the typical parchmentlike crepitation, with distinct fluctuation, was felt.

Roentgenograms showed a large cyst in the maxillary right side, from the alveolar ridge extending into the maxillary sinus and a smaller cyst in the cuspid region of the mandible (Fig. 4).

Clinical Diagnosis.—Follicular cyst.

Operation.—On June 22, 1935, under conductive anesthesia (novocain), a vertical incision was made in the lateral incisor region, carried to and along the alveolar ridge, to the third molar region. The mucoperiosteal flap was elevated from the bone, and the cyst was removed in its entirety from the maxillary sinus (Fig. 5).

A large part of the lateral wall of the sinus was completely obliterated as a result of resorption, but the inner wall and the orbital plate appeared to be normal. The cavity was cauterized and a drain inserted. The flap was approximated and sutured.

Pathologic Examination.—The cyst sac had an outer covering of bluish color, and it contained a thick brownish straw-colored fluid.

Fig. 6.—Case 3. Before operation. Fig. 7.—Two months after operation.

Microscopic Examination.—The sections of the wall of the cyst were lined by stratified squamous epithelium. Beneath this there was a wall of connective tissue infiltrated with round cells and an occasional plasma cell.

Final Diagnosis.—Follicular cyst.

Comment.—Since the patient's mouth was edentulous, and the patient had experienced no symptoms until a few weeks before coming into my office for an examination, she had not suspected cysts. (Figs. 6 and 7.)

We must not presume, therefore, that merely because a mouth is edentulous and the patient shows no symptoms there are not cystic areas present. It is good practice to examine by x-ray all edentulous mouths.

The cyst in the mandible was removed at a later date, and the patient made a complete recovery.

The next case is one with three separate cysts in the mandible. As the history will show, there were symptoms in the left posterior mandible, but there was no indication of cysts elsewhere.

Fig. 8. Fig. 9.

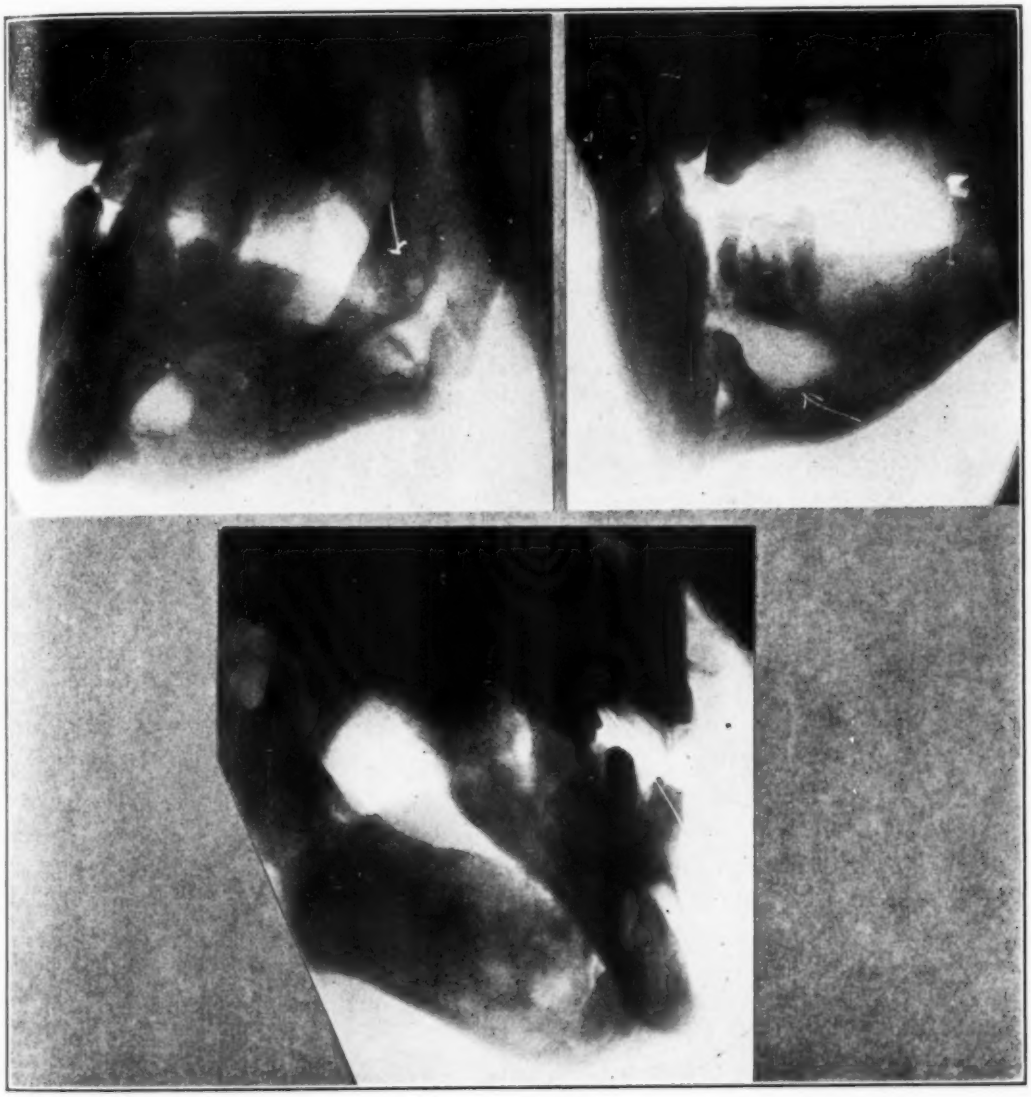

Fig. 10.

Fig. 8.—Case 4. Cyst in left side of the mandible, third molar region.

Fig. 9.—Left side of the mandible, cysts in the third molar and cuspid regions, with impacted teeth in the maxilla.

Fig. 10.—Cyst in the right incisor region, with impacted tooth in the maxilla.

CASE 4.—The patient, J. P., a white male, age 49 years, presented for examination, March 13, 1929.

History.—Patient complained that he had difficulty in opening his mouth. Intraorally there was a discharge of pus from the left third molar region. There were no teeth visible in the maxilla, but a few remaining teeth in the mandible.

The roentgenograms disclosed the following: There was a small well-defined area in the left third molar region of the mandible, a fairly large cyst in the mandibular left cuspid region containing two teeth, a cyst in the mandibular right cuspid region containing one tooth, and also impacted teeth in the maxilla, both left and right sides (Figs. 8-10).

Clinical Diagnosis.—Follicular cyst.

Operation.—A week later the cyst area in the posterior mandible, left side, was opened, and a small amount of what appeared to be cystic tissue was removed, and a drain inserted.

Pathologic Examination.—Connective tissue with squamous epithelium lining.

Final Diagnosis.—Follicular cyst.

Comment.—The patient did not return for the removal of the remaining cysts and impacted teeth. He experienced no discomfort from them; therefore he would not submit to additional operations.

This case again demonstrates the necessity for complete x-ray examination.

The following case of a cyst in the maxillary sinus is of particular interest because of the size of the cyst (filling the entire maxillary sinus) in a youthful patient, and because of the position of the permanent cuspid which was forced up and under the orbital plate.

Case 5.—The patient, I. U., a white female, age 12 years, presented for examination, June 6, 1929.

History.—She related that two weeks before she had had a swelling in the left region of the maxillary sinus, and a discharge of pus from the same area. At that time her dentist removed some deciduous teeth but the swelling and discharge persisted.

The patient had suffered intestinal trouble from the second to the fifth year, measles at 7 years, and scarlet fever at the age of 11 years. She was very nervous, without appetite, and underweight.

The child's mother had died of carcinoma during the patient's infancy.

Intraorally, upon palpation, over the maxillary sinus region, loss of bone could be felt, and also considerable fluctuation.

The roentgenograms revealed a cystic area filling the entire space of the maxillary sinus. There was a tooth, supposedly a cuspid, under the orbital plate of the maxillary sinus. (Fig. 11.)

Clinical Diagnosis.—Follicular (dentigerous) cyst.

Operation.—The operation was performed under ether anesthesia. The buccal wall of the sinus was found to be partially destroyed. The opening into the maxillary sinus was enlarged by means of a curette, and it was then possible to gain access to the entire cystic area.

The cyst was shelled out of the maxillary sinus, and the cuspid tooth was also removed. The tissue approximated was sutured, and an iodoform drain was inserted. (Fig. 12.)

Pathologic Examination.—(Microscopic) the sac was composed of fibrous connective tissue, very vascular throughout, and was lined with squamous epithelium.

Final Diagnosis.—Follicular (dentigerous) cyst.

Comment.—It was not necessary to remove any of the teeth because of the operation, except the cuspid tooth in the maxillary sinus. A short time after the operation the patient was less nervous, had gained weight, and had regained her appetite.

When cysts are accompanied by acute infection, they usually cause considerable pain. The patient's general condition, as in any other infection, is under par. Loss of appetite, a rise of temperature and pulse, and a corresponding increase in the white cell blood count are experienced. The history of the following case is typical of the acute infected cyst.

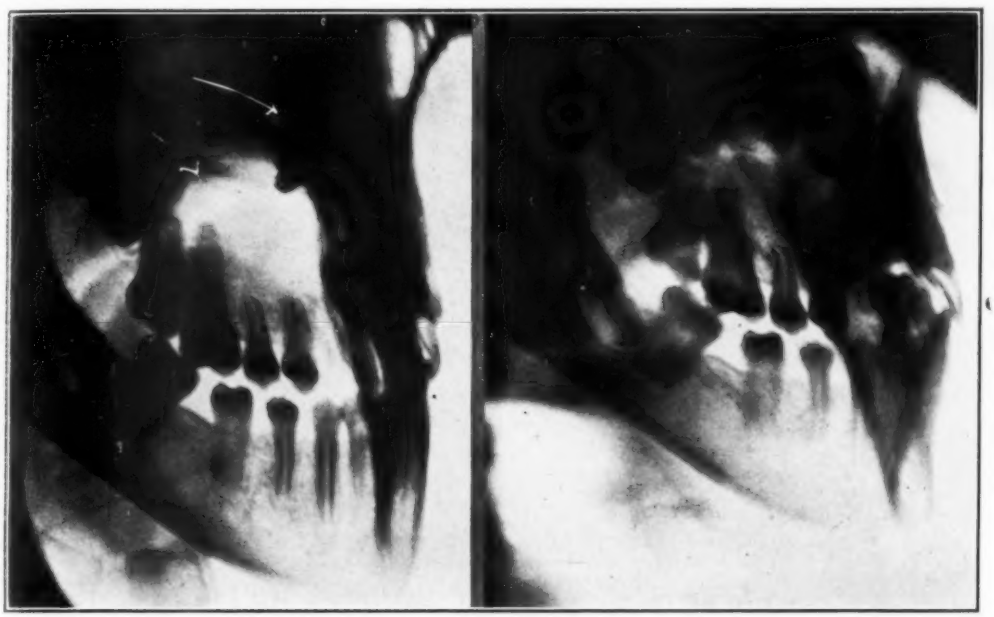

Fig. 11. Fig. 12.

Fig. 11.—Case 5. Cyst of the maxillary sinus with displacement of the cuspid (left side).
Fig. 12.—Several weeks after operation.

Case 6.—The patient, T. F., a white male, age 55 years, was suffering severe pain.

History.—I was called in consultation at the patient's home, June 17, 1930. There was a hard swelling extending high up into the left cheek almost closing his eye. He experienced difficulty in opening his mouth and in swallowing. Temperature, 101.4; pulse, 100.

Intraoral examination disclosed an indurated area extending over the entire ramus (Fig. 13). There was no evidence of crepitation or fluctuation.

Clinical Diagnosis.—Cyst.

Treatment.—An incision was made intraorally in the region just below the coronoid process, evacuating a small amount of pus, and a drain was inserted. After five days the swelling subsided, and the patient was able to open his mouth normally, and was very comfortable. Temperature, 98.4; pulse, 80.

On June 23, 1930, the patient presented himself at my office for further examination. Upon digital palpation in the ramus region, the area appeared to be normal.

The roentgenograms disclosed a defined area, high up in the ramus.

Final Diagnosis.—Follicular cyst.

Comment.—In an infected cyst, like this one, it is often wise to evacuate the pus by incision and drainage before operating to remove the cyst sac.

The patient would not submit to operation. Several years have elapsed, and the patient has not been operated upon, to my knowledge.

Extraoral roentgenograms are very important for a complete examination of the jaws. Many cysts in the ramus are missed entirely in our examinations. The importance of x-ray pictures, including the ramus, is clearly indicated in the following case.

Fig. 13.—Case 6. Cyst extending from the upper border of the ramus.

Case 7.—The patient, A. R., a white male, age 19 years, presented for examination, April 20, 1935. He had a swelling on the left side of the face, and complained of difficulty in opening his mouth. Intraorally the swelling extended from high up in the ramus to the mandibular third molar region.

Upon digital palpation there was a slight crackling, and upon pressure a flexible sensation was felt. An enlargement of this portion of the jaw itself was noticeable.

The roentgenograms revealed several cystic areas in the left ramus, extending from the coronoid process region to the lower border of the mandible, involving the entire ramus. The cystic areas extended to the third molar region anteriorly. (Fig. 14.)

Clinical Diagnosis.—Cystic adamantinoma.

Operation.—Under conductive anesthesia (novocain), an incision was made intraorally extending from high up in the ramus, anterior to the retromolar space, carried along the ridge of the ramus beyond the third molar region, and

downward halfway to the lower border of the mandible. The overlying flap was retracted from the bone exposing the cystic areas. Three distinct sacs were removed, and a frozen section was made in order to determine the nature of the growth. The bone cavity was cauterized, and the tissue was approximated and sutured. An iodoform pack was inserted.

Pathologic Examination.—Microscopic examination showed dense fibrous connective tissue stroma with numerous columnar epithelium cells.

Final Diagnosis.—Cystic adamantinoma.

Comment.—This case was followed for more than a year. New bone had formed, filling the cavity completely. There were definitely no signs of recurrence of growth. The postoperative roentgenograms showing results are not available at present.

It is my opinion that the discovery of these growths, before they become too extensive, will enhance the possibility for permanent cure.

Fig. 14.—Case 7. Cystic adamantinoma involving the entire left ramus.

Recently we have found that when cases of adamantinoma are followed by deep x-ray therapy (daily doses, 169 r-200 K B for a month), satisfactory results have been obtained.

My statement that cysts are found in any part of the jaw can be better emphasized by using the next case as an example.

Case 8.—The patient, M. D., white female, age 42 years, presented for examination, June 6, 1936.

History.—She complained of soreness in the lower left mandible and difficulty in opening her mouth. She had a large swelling in the cheek and in the submaxillary gland region. On palpating intraorally over the swollen area, there was no evidence of cyst formation.

The patient related having had an appendix operation seven years previously. In childhood she had had typhoid fever.

The roentgenogram revealed an impacted cuspid tooth lying horizontally in the lower border of the mandible with a cystic area about it (Fig. 15).

Clinical Diagnosis.—Follicular (dentigerous) cyst.

Operation.—On June 6 an incision was made intraorally, evacuating a small amount of pus, and a drain was inserted. The swelling gradually decreased. On June 15, under ether anesthesia (nitrous oxide), an intraoral incision was made, extending along the buccal plate of the mandible from the molar region and carried to the cuspid region, then downward almost to the lower border of the mandible. The mucoperiosteal flap was reflected from the bone. An opening had to be established into the cystic area by means of a bone drill. The opening was enlarged with a bone gouge. There was very little bone over the cuspid. The tooth was elevated from the mandible, and the cystic area was curetted. The cavity was cauterized, the tissue approximated and sutured, and an iodoform drain inserted. (Fig. 16.)

Pathologic Examination.—(Microscopic) connective tissue lined with squamous epithelium.

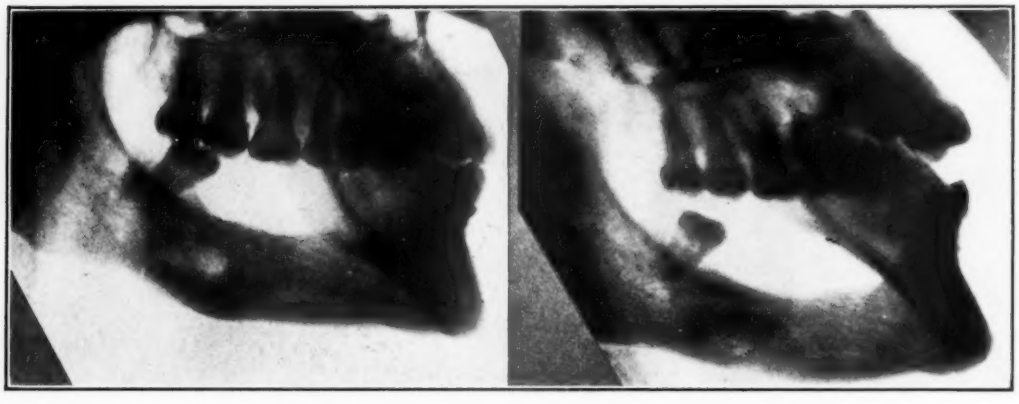

Fig. 15. Fig. 16.

Fig. 15.—Case 8. Cyst with cuspid tooth in the left molar region at the border of the mandible.

Fig. 16.—Left side two years after operation.

Final Diagnosis.—Follicular (dentigerous) cyst.

Comment.—The patient had a horror of being scarred, therefore the operation was performed intraorally, making it considerably more difficult than if an extraoral operation had been performed. The only justification for intraoral operation was the result attained.

I shall conclude with two cases, both of which were dentigerous cysts, both having apparently the same cause, but, as the illustrations will reveal, there was a vast difference in their size.

The first case is of an unusually small dentigerous cyst, and the second perhaps one of the largest jaw cysts ever placed on record.

Case 9.—R. J., white female, age 13 years, presented for examination, March 21, 1936.

History.—She complained of a pain in the mandibular right molar region. The patient was seemingly in splendid condition. Intraoral examination revealed a fairly well-kept mouth. The mucous membrane appeared to be pink

and healthy. She had several fillings and two cavities, a large one in the mandibular right first molar, and a small one in the mandibular second bicuspid. There was no evidence of any other trouble.

Complete x-ray examination revealed that the mandibular right first molar definitely was infected. There was also a small dentigerous cyst involving the mandibular right cuspid, which was lying horizontally near the border of the mandible (Fig. 17).

Clinical Diagnosis.—Dentigerous cyst.

Comment.—The patient did not submit to operation.

Case 10.—The patient, R. S., a white male, age 19 years, first appeared for examination, January 10, 1931.

History.—He complained of a discharge of pus from the mandibular right cuspid region intraorally, but no swelling or pain accompanied this ailment. In childhood he had measles but no other contagious diseases.

Fig. 17.—Case 9. Small dentigerous cyst, with cuspid at the border.

The patient was a young man five feet, four inches tall, and weighed 105 pounds. His skin was white, the pallor of the face giving him a distinctly emaciated appearance; but there was neither swelling nor glandular involvement.

Intraoral examination revealed a discharge of pus in the cuspid region of the mandible, right side. The teeth on the left side of the mandible beginning with the second bicuspid and including the incisors were displaced forward and toward the right. The right first molar was displaced lingually and pushed forward. The mucous membrane in this region was red in color, and upon digital palpation there was a distinct evidence of fluctuation.

Roentgenograms revealed a central lesion producing expansion of the bone. It involved the portion of the body of the mandible between the second molar on the right to the first molar on the left. In the film of the right mandible, in the region of the symphysis, there was an unerupted tooth. It was also shown in the film of the left mandible. There seemed to be a continuation of the intact bone at the border of the mandible.

Clinical Diagnosis.—Dentigerous cyst.

Because of the enormity of the cyst, and not unmindful of the possibility of its being sarcoma, it was deemed advisable to perform a biopsy. Accord-

ingly, a section was sent to the late Dr. Joseph C. Bloodgood of Johns Hopkins University. An abstract of his report follows:

"In making frozen sections of the piece of fibrous tissue which you removed from a cyst of the mandible, right side, in which there was an unerupted tooth. With low power I see a mixture of epsin stained stroma, lymphoid cells, and granulation tissue with a bit of mucous membrane, which

Fig. 18. Fig. 19.

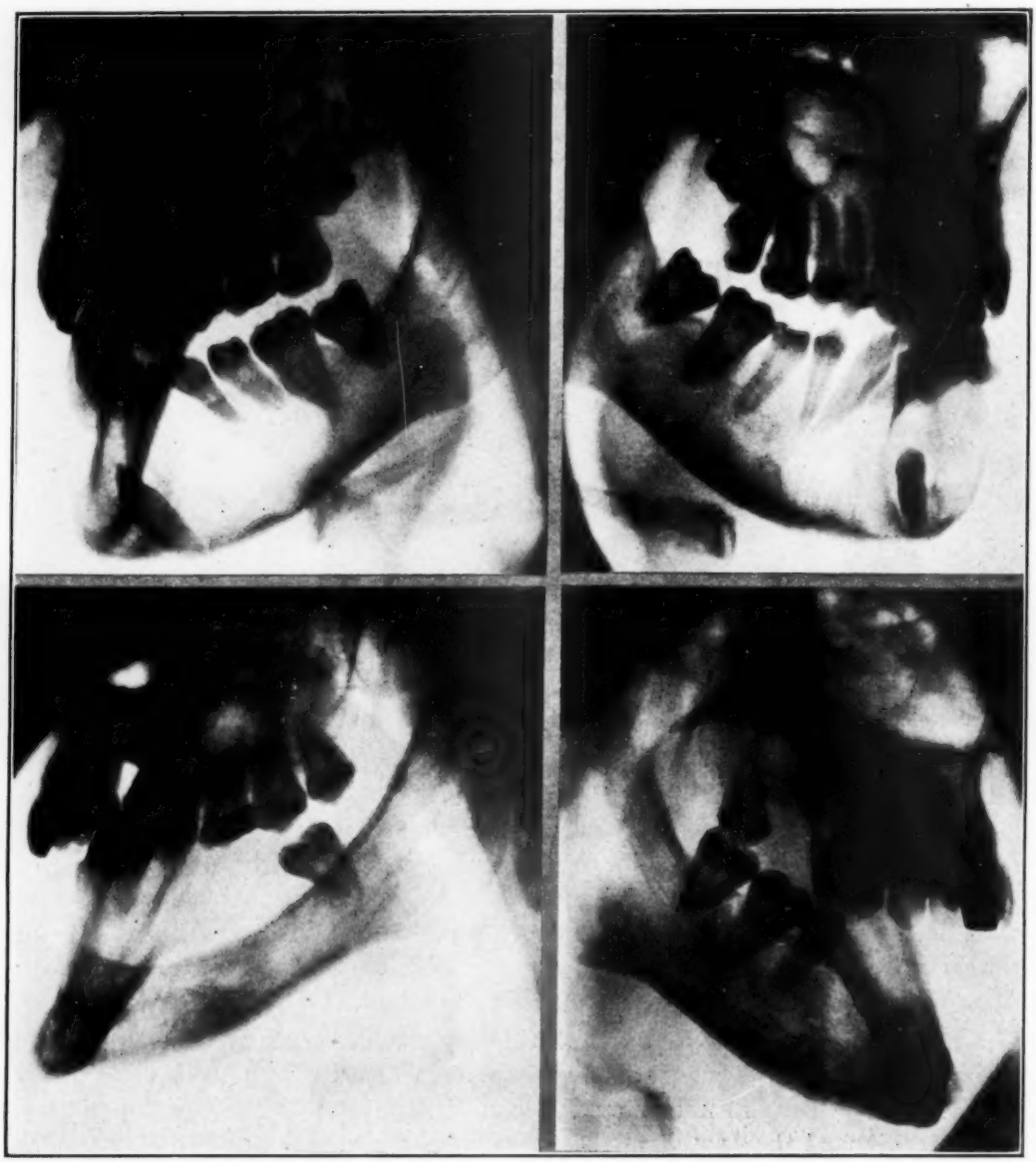

Fig. 20. Fig. 21.

Fig. 18.—Case 10. Large dentigerous cyst of the right side of the mandible, with cuspid at the border of the incisal region.

Fig. 19.—Left lateral view of cyst, showing cuspid which was actually on the right side of the mandible.

Fig. 20.—Right side five years after operation.

Fig. 21.—Left side five years after operation.

is normal. If this was removed from inside the cyst, then it represents epithelial lining. Beneath this zone of epithelium which is more like mucous membrane is skin in which we see no granulations or hair follicles. There is a lymphoid cell granulation tissue with some plasma cells. Lymphoid cell granulation tissue arranges itself about the blood cell, and is buried in epsin stained tissue. I will make another section at the laboratory tomorrow. I

Fig. 22.—Region of symphysis five years after operation.

Fig. 23. Fig. 24. Fig. 25.

Fig. 23.—Patient before operation.
Fig. 24.—Patient wearing appliance after operation.
Fig. 25.—Patient five years after operation, wearing mandibular restoration.

cannot make out any adamantine epithelioma. Even if it were difficult to differentiate these round cells from lymphosarcoma, one would not expect a sarcoma in this history, x-ray, and operative findings. I think you are dealing with a dental root cyst."

There was possibility that a bone graft might be necessary, so Dr. Paul N. Jepson was consulted.

Operation.—(Performed by Dr. Paul N. Jepson and myself.) On January 19, 1931, under ether anesthesia, an incision was made extraorally, directly

under the lower border of the mandible, extending from the right cuspid region to the incisor region. The mucoperiosteal flap was reflected from the bone. A small amount of bone was then removed exposing what appeared to be a dentigerous cyst. The cyst and the cuspid were removed, as were the teeth related to the cyst; namely, the teeth from the first molar right side to the second bicuspid left side. The cavity was then cauterized with phenol, a rubber dam drain inserted, and the tissue approximated and sutured.

Because of the extensive loss of bony structure, we deemed it wise to limit the patient's jaw motion, so we inserted an appliance which I had previously designed for jaw fractures. This precautionary measure was to prevent any such complication. The patient wore the appliance for several weeks.

Final Diagnosis.—Dentigerous cyst.

Progress.—The wound drained freely after operation until January 30, 1931. During that time he suffered very little pain. The swelling was kept under control by cold compresses.

The patient was out of bed on the fifth day after operation. On February 1, 1931, the drain was removed, and the patient was discharged from the hospital.

The patient came to my office February 2, 1931, and the wound was irrigated with Dakin's solution daily until February 28, 1931. There was no discharge, and the wound was completely healed.

Series of films were taken, lateral jaws, and bite films, starting February 2, 1931, to February 12, 1935. It was of interest to note the gradual regeneration of bone which was disclosed by each succeeding roentgenogram. Final films show new bone filling what was once the cyst cavity.

The patient is now married, living a normal life, and working at his chosen trade. He has gained weight, his color is good, and he shows no ill effects from the operation, with the exception of a slight scar directly under the border of the mandible.

Comment.—The patient had a much more substantial jaw than the roentgenograms indicated, and it was not deemed necessary to resort to bone graft.

In my opinion the outstanding feature of this case is the regeneration of bone, filling the large cavity which the cyst occupied. It clearly demonstrates that nature, given half a chance, will often do a great deal more than man can and with far more efficiency. This case demonstrates conclusively that conservative surgery can be resorted to in most cases of jaw cysts.

SUMMARY

The purpose of this presentation is to emphasize the necessity for complete examination of both upper and lower jaws. Clinical observation is not enough. More important is the taking of a complete series of roentgenograms. A complete series is one that takes in the molar to molar region, both upper and lower jaws, and extraoral roentgenograms of both right and left sides.

If the routine of complete examination is followed and surgical interference is immediately resorted to, many jaw cysts would be checked in their growth, and much unnecessary suffering would be eliminated.

With the x-ray machine at our elbow, there is little excuse for not making good use of it. Prevention is the keynote of medicine and dentistry today. It is our duty, therefore, to be certain that our patients are properly examined.

CONCLUSION

Early discovery of jaw cysts and prompt operation would often save our patients from pain, loss of business, social activity, disfigurement, and possibly, in some instances, loss of life.

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BLOOD DYSCRASIAS FROM A DENTAL POINT OF VIEW

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(Continued from page 476, May issue)

PART II

APLASTIC ANEMIA

THE basic feature in this disease is a failure of hemopoisis, chiefly involving the red cell production, although the marrow leucocytes and the platelets are apt also to be affected. In true aplastic anemia the bone marrow failure is more rapid and severe, and there is more interference with the production of white blood cells and platelets than in other anemias in which, toward the end, an aplastic factor is present.

Bone marrow insufficiency may manifest itself clinically as aplastic anemia when the marrow fails as a unit. In patients suffering from aplastic anemia there is an absence or extreme paucity of evidence of regeneration of blood cells. There may be little change in the individual erythrocyte. There is usually leukopenia. The platelets are reduced also, and sooner or later purpuric manifestations complicate the picture of anemia. The cases of aplastic anemia reported usually have followed exposure to the toxic action of arsphenamine, radium, x-ray, or benzene. An infection may occasionally lead to total paralysis of the bone marrow. No etiology has been ascribed in some of the cases. The prognosis of idiopathic aplastic anemia is grave, death usually supervening within three months, regardless of the treatment.[22]

	NORMAL BLOOD COUNT	APLASTIC ANEMIA
		Illustrative Blood Count Pepper-Farley[23]
R.B.C.	4,500,000 to 5,000,000	1,210,000
W.B.C.	5,000 to 10,000	2,200
Hemoglobin	90% to 100%	18%
Neutrophiles	68% to 70%	19%
Monocytes	4%	4%
Lymphocytes	20% to 25%	77%
Platelets	250,000 to 300,000	85,000
Bleeding time	2 to 5 minutes	7 minutes
Coagulation time	3 to 7 minutes	normal

The following case history is of dental interest.

On August 16, 1934, a male negro, aged 25 years, was admitted to the University Hospital, at which time the following history was obtained.

From the University of Pennsylvania, School of Dentistry.

July 22, 1934: Patient had gaseous eructation and malaise.

July 26: "Blood blisters" appeared on the lips and gums.

August 6: The mandibular right first molar was removed under novocaine. The patient bled freely following the extraction, and had done so up until admission to the Hospital (Fig. 2). Following the extraction severe headaches developed in the occipital region. There was dizziness, and the patient fainted four times in the following two days.

August 16: On admission to the Hospital: The tooth socket appeared as if the tooth had been removed only a few hours before. The wound looked clean. There was no ulceration, but there was oozing of blood. Although the gums did not appear swollen, there was hemorrhage from various points.

August 17: Hemorrhage stopped following transfusion, but began again on August 19. Bleeding continued intermittently, and finally stopped on October 10. Eight transfusions were given in the course of treatment.

November 14, 1934: The patient walked out of the Hospital, feeling well.

Table I gives the blood studies.

Fig. 2.—This photograph taken ten days after the removal of the mandibular right first molar shows bleeding from that region as freely as if the tooth had just been removed. This patient had aplastic anemia.

TABLE I

	R.B.C.	% HB.	W.B.C.	% NEUTROPHILES	% LYMPHOCYTES	% MONOCYTES
8-16-34	1,640,000	38	1,750	21	78	1
8-18-34	1,740,000	43	1,700	16	80	2
8-20-34	2,100,000	43	1,420	8	88	4
9- 1-34	3,300,000	50	2,900	14	76	10
9- 4-34	2,300,000	42	2,100	16	80	4
9- 8-34	1,700,000	30	2,300	19	78	2
10-22-34	2,800,000	42	4,000	21	75	4
11-10-34	2,400,000	48	3,100	29	67	4
11-19-34	2,900,000	55	4,000	28	67	5
*3-18-35	4,400,000	90	4,200	43	50	7
*10-21-35	4,000,000	90	3,600	45	73	9

*Blood counts made in Check-up Clinic.

Heck[24] believes that if reticulated erythrocytes cannot be demonstrated on repeated examination of smears, or if there are constantly very low values for reticulated erythrocytes, together with increasing leukopenia and relative lymphocytosis, and if all the leukocytes are adult forms, one would be on fairly safe ground in making a diagnosis of this disease.

LEUKEMIA

According to Pepper,[23] "the term 'leukemia' was originally adopted to describe progressive and persistent increase of the white blood cells with no thought of the cell types involved nor of the tissues whence they were derived. Today we continue the usage, even though it is realized that the blood is not the seat of the primary morbid process, and that the several disorders included under this one term probably differ as widely in etiology as they do in symptoms and blood picture."

Watkins[25] reports: "The name 'leukemia' implies a condition in which there is an abnormal increase in the number of leukocytes in the peripheral blood, with many of the individual cells showing the features of immaturity. The more acute the process the more evidence of immaturity is found. Full dependence for a diagnosis of leukemia must not be placed on a high leukocyte count, for in many instances in the presence of acute or chronic leukemia the total leukocyte count may be less than 10,000 cells for each cubic millimeter of blood, or even marked leukopenia may be present. In approximately 45 per cent of the cases of acute leukemia seen at the Mayo Clinic during the last four years, the total number of leukocytes has been less than 10,000 cells for each cubic millimeter of blood. Morphologically, the diagnosis may be readily made by finding immature leukocytes, with a high proportion of myeloblasts and very immature lymphocytes if lymphatic in type."

Easton,[26] in reporting three cases of acute myelogenous leukemia, stated that "the main features of these cases are an intensely severe sepsis in the mouth, associated with a marked and increasing secondary anemia and a white count in the early stages showing a leukopenia affecting the granular cells, followed by the appearance of a leukemic picture of the myelogenous type."

Two of the patients seen by Easton presented the following:

CASE 1.—A male, aged 19 years, was admitted to King's College Hospital on November 12, 1928. Two months previously an "abscess in the mouth" was lanced, which was followed by weakness, giddiness and headaches. On admission there was a severe ulcerative condition of the mouth, and the right side of the face was puffy and swollen; he had difficulty in opening his mouth. The blood picture was as follows: R.B.C., 738,000; W.B.C., 800; hemoglobin, 15 per cent; polymorphonuclear cells 18 per cent; lymphocytes 82 per cent.

The patient died on January 1, 1929. The W.B.C. at that time was 10,600 and lymphocytes 7 per cent.

CASE 2.—A female, aged 28 years, was admitted to the hospital on March 1, 1929, with a four months' history of giddiness. Ten days previously an acute illness developed with sore throat and swollen face. Examination of the mouth revealed: gums so swollen and edematous that they almost completely obscured the teeth, severe stomatitis, and patient's face so swollen that she had great difficulty in opening her mouth. The blood count was as follows: R.B.C., 1,408,000; W.B.C., 5,200; Hb., 32 per cent; polymorphonuclear cells, 54 per cent; lymphocytes, 43 per cent; large mononuclears, 3 per cent.

The patient died on March 21. The blood count before death was R.B.C., 884,000; W.B.C., 19,800; Hb., 19 per cent; polymorphonuclear cells, 57 per cent; lymphocytes, 18 per cent.

Necropsy findings revealed a severe necrosis of the maxilla and the sides of the body of the mandible.

Easton[26] felt that it is hard to believe that a clinical picture such as he described in his cases "could be produced by the lowering of the patient's resistance by a process which affects the blood forming organs and of the nature of which we are completely ignorant." In believing that infection is the essential cause, he advanced the following theory: "that the blood picture in many cases of acute myelogenous leukemia is a special response of the hematopoietic system to a virulent infection," and that "the process seems to be evolved in this way: the organism gains an entrance to the body, commonly at the site of septic tonsils or teeth, and sets up a severe inflammatory reaction."

Watkins[25] reports a case from the Mayo Clinic as follows:

A man, aged 60 years, was seen at the Clinic on January 28, 1932. On January 11 he was diagnosed (elsewhere) as having pernicious anemia; later when the anemia became more profound and bleeding from the gums and hemorrhage into the bowel developed, he was diagnosed (elsewhere) as having hemorrhagic purpura. On admission, there was marked hemorrhage from the gums and nose. Blood count revealed R.B.C., 1,260,000; W.B.C., 4,900; platelets, 48,000. A diagnosis of acute myelogenous leukemia was made; the patient died January 31.

At necropsy, changes typical of acute myelogenous leukemia were found in the organs.

Strumia[27] reported the following case:

Mr. J. T., aged 21 years, was admitted to the Misericordia Hospital, August 17, 1931. Ten weeks prior to admission he complained of shortness of breath on exertion and pain in the back. Two weeks prior to admission he complained of dizziness and headache. Three days prior to admission a tooth abscess developed.

August 17, 1931: Oral findings on admission: Slight oozing of blood from gums with stomatitis. A suppurative process about the mandibular right first and second molars with a fistula.
General: Temperature 103°.
Blood count: R.B.C., 1,160,000; W.B.C., 36,300.
Differential: hemocytoblasts and hemohistoblasts, 84 per cent; promyelocytes, 2 per cent; metamyelocytes, 1 per cent; prolymphocytes, 3 per cent; lymphocytes, 7 per cent; Turck cells, 3 per cent.
Diagnosis: acute leukemia of the myelogenous type.
Following month, leucocytes varied from 6,700 in number to 72,000.

September 15: Leucocytes dropped to 1,000.

October 5: Blood count presented an agranulocytic picture: R.B.C., 1,960,000; W.B.C., 550.
Differential: hemohistoblasts, 1 per cent; rod nuclears, 1 per cent; neutrophiles, 1 per cent; prolymphocytes, 3 per cent; lymphocytes, 94 per cent.
The granulopenic phase continued for one month. The leucocyte count was as low as 400; seldom over 1,000.

November 3: The undifferentiated myeloid cells reappeared in the blood stream.
Three weeks later blood count went from W.B.C., 2,100 to 430,000.

November 18: Again atypical acute leukemia.
Blood count: W.B.C., 240,000.
Differential: hemohistoblasts and hemocytoblasts (undifferentiated count), 41 per cent; myeloblasts, 40 per cent; promyelocytes, 4 per cent; myelocytes, 1 per cent; polymorphonuclears, 2 per cent; lymphoblasts, 3 per cent; lymphocytes, 5 per cent; Turck cells, 2 per cent; undetermined, 2 per cent.

November 20, 1931: Died, three months after the disease was diagnosed; five and one-half months after onset of symptoms.

Aison[28] was called in consultation by a dentist, May 14, 1931, to see a patient who had been treated by him, together with a physician, for about three weeks for what appeared to be Vincent's stomatitis, coincident with dentoalveolar abscess.

History: Patient, a white woman, aged 26 years, with no previous treatment, reported to dentist for treatment of sore mouth. Treatment by dentist: Found gums inflamed, spongy, bleeding, and there was a small raised ulcerated area on the lingual side of the maxillary right bicuspids. He scaled all the teeth and punctured the ulcer: a copious flow of blood appeared, which was never completely arrested. Office treatment was continued the following week without improvement; then a physician was called in. A smear showed Vincent's organisms. Topical treatment was given by dentist, and intravenous injection by the physician was instituted. Aison found in the mouth a bleeding ulcer 3 cm. in circumference, covered with grayish slough, extending from the lingual surface of the bicuspids and molars to the midline of hard palate. No blood count had been made up to that time, but taken that day showed: R.B.C., 3,160,000; W.B.C., 33,600; Hb., 58 per cent. Differential: neutrophiles, 5 per cent; lymphocytes, 62 per cent; lymphoblasts, 29 per cent. Diagnosis: Acute lymphatic leukemia. On May 18, the patient died.

Case 1.—A female, aged 35 years, was admitted to the University Hospital, October 28, 1935. My entrance into the case was on October 31. The patient complained of pain in the region of the mandibular right first molar, and that a week previously she had had pain in the maxillary left molar region. On examination the following was found: marked gingivitis on the palatal surface, especially in the region of the maxillary incisors (Fig. 3), the teeth were firm and in excellent condition; in the mandible, the right first and second molars were slightly loose, and there was some ulceration on the lingual surface in the same region. There was a marked fetor oris. An attempt to have dental roentgenograms was made, but because of the great discomfort it was only possible to get films of the mandibular right side, which disclosed considerable horizontal absorption of the alveolar process. Fortunately, no attempt at extraction was made, for in forty-eight hours the ulceration had extended distally to the third molar, and mesially to the first premolar on the buccal and lingual surfaces. In spite of the fact that medication was started after the first visit, ulceration gradually became worse. The progress of the ulceration on the palate was amazing, starting as what appeared to be an innocent gingivitis, within a short time ulcerating (Fig. 4), and finally necrosis developed (Figs. 5 and 6). It was necessary, daily, to remove parts of this necrotic mass to allow the nurse to pass a glass tube through which the patient was fed liquids. In the maxillary molar region the soft tissue had extended over the occlusal surface of the teeth, so that it was impossible for the patient to close her mouth. The odor was beyond describing. Before death the patient's face was swollen beyond recognition. The diagnosis was acute lymphatic leukemia.

Case 2.—A Russian, aged 69 years, was admitted to the hospital December 21, 1931. Blood count: R.B.C., 3,000,000; W.B.C., 7,900; Hb., 73 per cent. Differential: neutrophiles, 28 per cent; lymphocytes, 60 per cent; large monocytes, 8 per cent; eosinophiles, 3 per cent; myelocytes, 1 per cent.

December 28, 1931: Blood count: R.B.C., 2,700,000; W.B.C., 14,000; Hb., 67 per cent. Differential: neutrophiles, 14 per cent; lymphocytes, 80 per cent; mononuclears, 3 per cent; eosinophiles, 3 per cent.

January 4, 1932: W.B.C., 67,000, mostly lymphoblastic and lymphocytes (90 per cent); a few polymorphonuclears and eosinophiles, and an occasional myelocyte.

Slight enlargement of left side of neck (below the submaxillary gland). Difficulty in swallowing food.

January 5: Blood count: R.B.C., 3,200,000; W.B.C., 65,000; Hb., 65 per cent. Differential: neutrophiles, 2 per cent; lymphocytes, 95 per cent; mononuclears, 1 per cent; myelocytes, 1 per cent.

January 20: A fistula made its appearance on right side of mandible (lingual surface). Small apicule made its appearance. X-ray examination disclosed an unextracted root in the molar region with considerable bony destruction about it.

The root was removed with little difficulty—no anesthesia.

Fig. 3. Fig. 4.

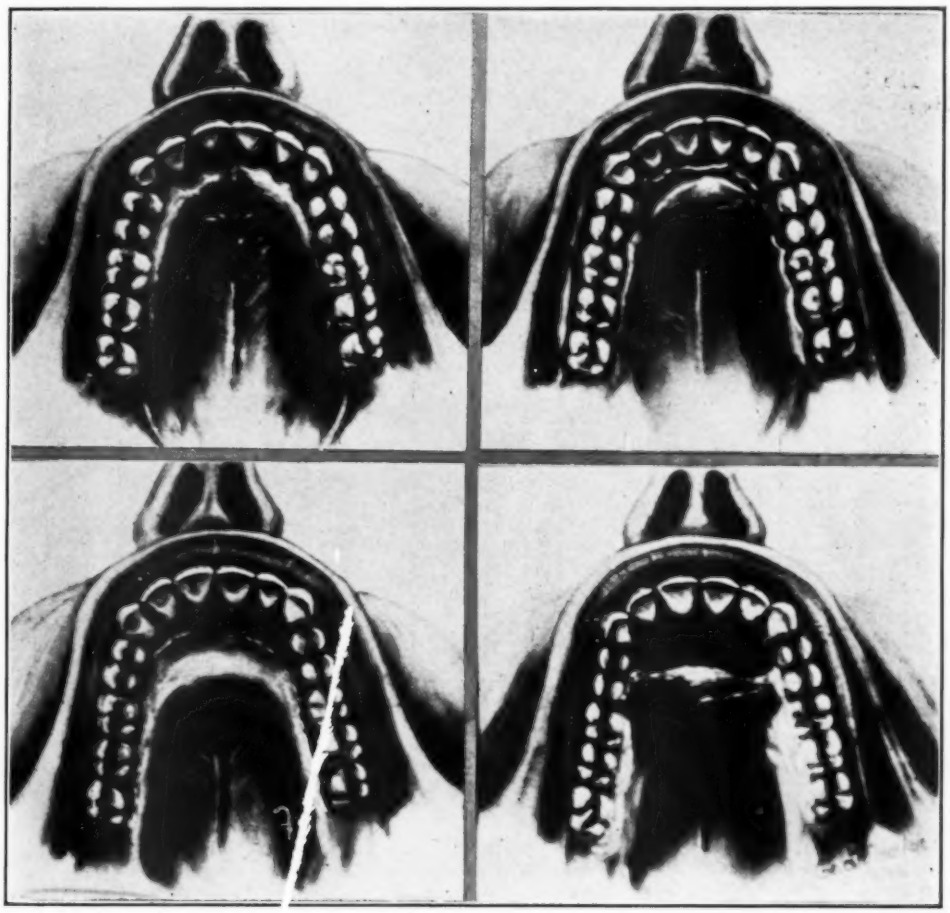

Fig. 5. Fig. 6.

Figs. 3-6.—Illustrations showing progress of infection in the mouth of a female patient, aged 35, whose disease was diagnosed as acute lymphatic leukemia.

Fig. 3.—Marked gingivitis in the region of the maxillary incisors lingually.

Fig. 4.—One week later, beginning ulceration.

Fig. 5.—Two weeks later, beginning necrosis.

Fig. 6.—Three weeks later, extensive necrosis extending posterior to the premolar region. This condition extended to the molar region to include the entire palate before death.

January 22: Considerable necrosis in the region from where the root was removed. Area very painful. Temperature 101.2.°

Blood count: R.B.C., 2,500,000; W.B.C., 72,000; Hb., 48 per cent. Differential: neutrophiles, 1 per cent; lymphocytes, 99 per cent.

January 24: Marked edema of the buccal mucous membrane and the floor of the mouth. Swelling of right submaxillary region. Necrosis quite extensive at site of extraction.

January 26: Blood count: R.B.C., 3,600,000; W.B.C., 98,000; Hb., 54 per cent. Differential: neutrophiles, 2 per cent; lymphocytes, 92 per cent; mononuclears, 3 per cent.
Edema of the soft palate and pharynx was more marked.

January 27: Patient died at 12:02 A.M.

CHRONIC MYELOGENOUS LEUKEMIA

CASE 1.—An Italian male, aged 48 years, entered the hospital November 22, 1935. The patient had been admitted on four other occasions. This case is interesting from a dental point of view because in spite of the fact that the patient made no particular effort to care for his mouth, there was never any evidence of oral lesions. The gums appeared pale and were firm.

The blood study is given in Table II.

TABLE II

	R.B.C.	W.B.C.	HB.	NEUTRO-PHILES	LYMPHO-CYTES	MONO-CYTES	EOSINO-PHILES	BASO-PHILES	MYELO-CYTES	BLAS.
(1st Admission)										
5-15-33	2,800,000	95,000	45%	81%	2%	1%	3%	2%	11%	
(2nd Admission)										
10-22-34	2,200,000	90,000	40	50	9	5	2	2	26	
(3rd Admission)										
1- 2-35	3,900,000	32,000	74	71	8	3	1	2	15	
(4th Admission)										
9-13-35	2,200,000	50,000	35	42	3	0	2	1	52	
(5th Admission)										
11-22-35	1,800,000	9,500	24	66	8			1	17	
11-25-35	1,200,000	6,700	20	71	8				20	7
12- 5-35	1,700,000	11,300	23	59	3				20	6
12-13-35	1,500,000	14,800	18	25	9				17	4
12-20-35	1,500,000	19,500	20	55	7		14		54	5
12-30-35	1,600,000	15,100	25	66	9		15		28	
1- 6-36	1,600,000	12,800	26	64	14				16	5
1-13-36	1,500,000	32,000	25	68	8				31	6

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(To be continued)

Case Reports

This month three new cases are presented to our readers. Discussion of preceding cases as well as the ones this month is invited by the editors. Please mail your comments to Dr. Kurt H. Thoma, 47 Bay State Road, Boston, Mass. Readers are also invited to contribute to this department by sending for publication cases of their own that might interest others.

CASE REPORTS NOS. 4, 5, and 6

EFFECTS PRODUCED BY IMPACTED THIRD MOLARS

H. M. Brock, D.D.S., Port Angeles, Wash.

CASE REPORT NO. 4

History.—M. B., a boy of 18 years, well developed, had severe pains in the frontal part of the head for which he went to a capable eye, ear, nose and throat specialist, who fitted glasses to relieve the pain, but the glasses did not improve the condition.

He next had a distress in the chest and went to the school chest clinic. They could find no evidence of tuberculous conditions but were suspicious of it.

The next manifestation of pain was in the stomach or solar plexus. He was put to bed for two months and was treated by two physicians for stomach or intestinal influenza.

Examination.—At that time, about five months from the first manifestation of pain, I was called because of severe pain in the mandible anterior to the mental foramina. I examined the twenty-eight teeth present and found them in perfect condition with neither a filling nor a cavity. The gingivae were healthy. I advised x-ray examination of the teeth.

Roentgen Examination.—X-ray pictures of the unerupted third molars were made; these did not show the apices of the roots (Fig. 1), but the angle at which they lay and the small part of the mandibular canal visible made me reasonably sure that their roots were growing into the mandibular canal, and impinging upon, and bringing a constantly increasing pressure upon, the alveolar nerve.

Treatment.—I advised that the patient be taken to Seattle to an oral surgeon, which was done. A stomach specialist was consulted, and he thought they had better wait until the patient was stronger before having the third molars removed, as he was, by this time, quite emaciated. So he was brought back without removal of the teeth.

I said that I was sorry for he could not improve until these teeth were removed; and at the end of two weeks, as he was no better, I again suggested they take him to Seattle for the extraction. Instead they took him to the hospital. At the end of two weeks the eye specialist who first saw him was called to the hospital to examine the x-ray pictures of the sinuses, but there was no infection present. The patient, however, was unable to keep anything on his stomach, which was believed to be due to the medicine they had given

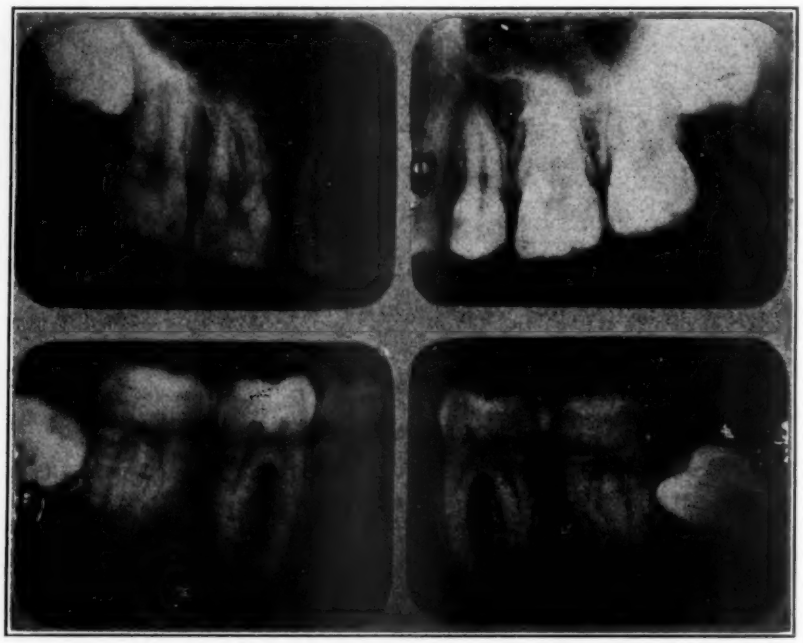

Fig. 1.

Fig. 2.

him to alleviate the pain. The specialist agreed with me that unless the impacted third molars were removed the patient would collapse from the pain and the lack of nourishment, which would be the end. So he was again sent to the oral surgeon and this time the third molars were removed.

Result.—The stomach pain which had been continuous for two months disappeared immediately, and the headaches also disappeared a few days later. The patient began to eat heartily, and in a few weeks his weight had increased from 107 to 135 pounds. He has been in perfect health ever since.

CASE REPORT NO. 5

In the fall of 1937, about a year and a half after the case of M. B. (Case No. 4), his twin sister, F. B., came to me complaining of pain in the region of the third molar, which was referred to the back of the ear. X-ray pictures were taken of the mandibular third molars; these showed the roots extending into the mandibular canal (Fig. 2). Prompt relief followed their removal. Frontal headaches disappeared and the patient was able to discard her glasses.

CASE REPORT NO. 6

History.—Mrs. R., aged 20 years, married, and had a small child. She complained of pain on the right side of the forehead, and had glasses fitted that did not bring relief. X-ray examination (Fig. 3) showed roots of the mandibular third molar causing pressure on the mandibular alveolar nerve. I removed this tooth with novocaine conduction anesthesia. The patient was completely relieved of the pain in the head in two or three days.

Fig. 3.

DISCUSSION

Dr. Brock.—The pressure on the mandibular alveolar nerve may cause a reflex through the Gasserian ganglion to the ophthalmic of the fifth and be felt in the supraorbital of the forehead and frontal part of the scalp, where it is manifested as pain.

In other cases the pain is referred through the mandibular and auriculotemporal to the otic ganglion where a branch connects with the supercervical ganglion, the petrono ganglion of the ninth nerve, and the root ganglion of the vagus. This connects it with both the sympathetic and the parasympathetic system so that there may be a retarding or stimulating effect on the throat, chest, heart, stomach, liver or kidneys.

I believe that these remote effects of pressure upon the fifth nerve are more frequent than is recognized, and often are attributed to infection, resulting in mistaken diagnosis.

Dr. Frank W. Rounds, Boston, Mass.—Dentists, oral surgeons, and exodontists are frequently consulted by family physicians and sometimes by patients themselves, to consider teeth as possible causes for headaches, referred pains to the supraorbital region, the ears, and the base of the skull; also for stiffness and dull aches in the back of the neck and the area of the cervical vertebrae. By and large, the physician is looking for possible infection. The thought of pressure on the mandibular alveolar nerve, generally, has not been entertained. There has been ample clinical evidence in many practices that nature's efforts to push impacted teeth to the surface exert a reverse pressure which may easily result in discomfort in the areas mentioned as well as causing neuroses of various types.

Dr. Brock has explained in his discussion how logical it is that impacted third molars should be responsible for these reflexes. He has also clearly demonstrated how the sympathetic system may be involved. This latter viewpoint should be given more consideration in disturb-

ances of obscure etiology. The manifestations he describes are usually solved in the fields of the rhinologist, the oculist, the otolaryngologist, or the dentist. Eyes, ears, throats, sinuses, and teeth are the common offenders, and the teeth are often considered last by the medical profession and then only when, by elimination, the other organs have been found to be innocent.

It is generally admitted that impacted third molars are a menace to the health and comfort of the patient, besides being a causative factor in various dental disturbances. Since in the aggregate they do not and cannot be made to function physiologically; since they are more easily eliminated in youth than in maturity, with less trauma and shock; since adolescent patients recuperate from these operations more readily and with quicker regeneration; and since the referred pressure signs are seen more frequently during the developmental period of life, it would seem more of a duty than has been generally recognized to condemn such potential trouble-makers as a primary measure rather than as a last alternative. This in my opinion is one phase of preventive dentistry which has not been given sufficient prominence.

Adequate radiographs which tell the whole anatomic story and the nerve relationship are imperative diagnostic aids, and it goes without saying that well-planned, non-overtraumatizing operative technique contributes to the success of the result. Careless operating in cases such as shown in Figs. 2 and 3 may cause nerve trunk injury and exaggeration of symptoms. In Case No. 4 we see an instance of unnecessary, delayed suffering, the dentist having been consulted as a last resort and then only because of local symptoms.

Department of Orthodontic Abstracts and Reviews

Edited by

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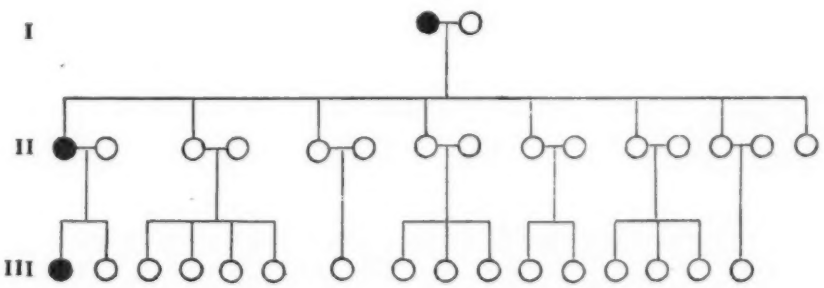
Dr. Rubbrecht's Studies on Sagittal Maxillo-Facial Variations and Heredity. By L. Lindsay, L.D.S., Edin., Dental Record **58**: 113, March, 1938.

Cephalometric measurements show that it is less essential to consider the position of certain teeth in the jaws than certain features belonging to the jaws which maintain their characteristics whether the teeth are present or absent (Rubbrecht). The diagnosis of jaw anomalies must be made in reference to cranial points and points of the face.

MANDIBULAR PROTRUSION AND MAXILLARY RETRUSION

The material examined indicates that cases of mandibular protrusion and maxillary retrusion are, in the great majority of instances, due to hereditary



Figs. 1, 2, and 3.—Genealogic tables for mandibular protrusion and maxillary retrusion.

factors and only exceptionally have a local cause (Figs. 1, 2, and 3). They are manifestations of variations; the forward growth of the maxilla is retarded in the course of evolution and—in a sagittal direction—remains behind the development of the mandible. In other cases, the maxilla is approximately normal in size, and morphologic variation depends largely upon the overdevelopment of the mandible. The relative size of maxilla and mandible plays a greater role than the absolute size; a maxilla, for instance, which is the cause of retrusion in one mouth may not be so in another; or a mandible which is the cause of protrusion in one individual may be regarded as normal in another.

The shape of the jaw bones plays another important part. Furthermore, it is not sufficient for the development of a mandibular protrusion and maxillary retrusion that the mandible is large in relation to the maxilla, but this

extra size must be manifest in a sagittal direction. Heredity has a predominant influence upon shape; maxillary zones of the same shape have been found in successive generations while their size varied. Size and shape of maxilla and mandible may be affected either independently or simultaneously. Normal development of the jaw bones not only insures normal occlusion but brings about normal relations to other facial bones.

The variations which result in mandibular protrusion and maxillary retrusion are manifested by: (1) Retardation of the lengthening of the maxilla in relation to the mandible (which latter may or may not be normal): maxillary retrusion. (2) The mandible exceeds its normal limits (while the maxilla is normal): mandibular protrusion. (3) The inherited tendency to an over-

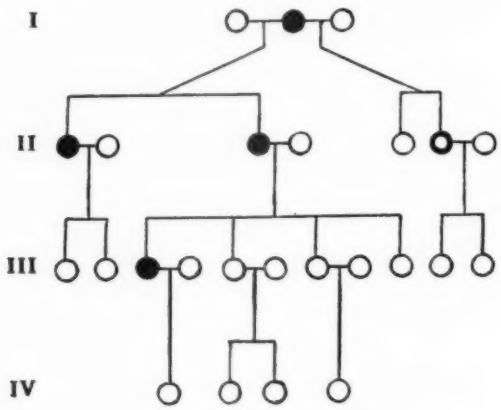


Fig. 2.

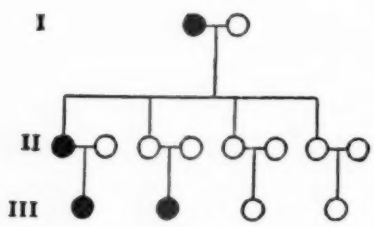


Fig. 3.

growth of the mandible is—in an anterior direction—impeded by local conditions and it develops backward abnormally (maintaining, however, the Class I characteristics of occlusion). (4) Both jaws are in positions of accentuated retrusion (with correct occlusal conditions). Exogenous forces may affect these conditions, and for this reason the mandible is more susceptible to changes than the maxilla.

MANDIBULAR RETRUSION AND MAXILLARY PROTRUSION

The influence of heredity upon mandibular retrusion and maxillary protrusion conditions is not so marked as in mandibular protrusion and maxillary retrusion; some authors go so far as to discount any connection, while others (Rubbrecht) admit a considerable influence (Fig. 4).

Among local causes, there are bad habits which undoubtedly produce some of the Class II conditions, but not many. Adenoids and tonsils are responsible for others.

Hereditary conditions appear in successive generations, but it should be noted that many of them show originally a hereditary tendency involving both jaws. The extension of the mandible forward has been retarded in the course of evolution.

As a result, we find the following conditions: (1) The maxilla does not exceed its normal limits forward and the mandible, as a result of retardation, remains distal: mandibular retrusion. (2) The mandible reaches full development, but the maxilla exceeds its normal limits: maxillary protrusion without

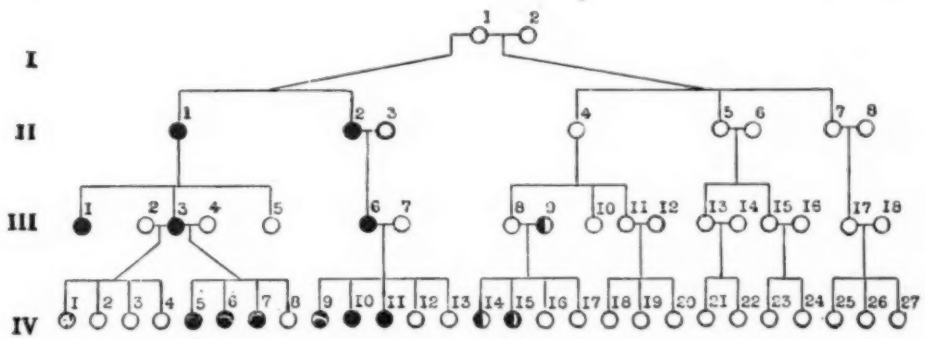


Fig. 4.—Genealogic table for mandibular retrusion and maxillary protrusion.

mandibular retrusion. (3) Both conditions are present simultaneously: maxillary protrusion plus mandibular retrusion.

Experiments in canine heredity (H. Ritter) demonstrate the results obtained by the crossing of a sheep dog and a bulldog which had a litter of ten descendants. One of these had anteroclusion of the left mandibular incisors; one had a bulldog denture; one a sheep dog denture; two had edge-to-edge bites; and five had dentures between the two extremes.

Observations on 96 pairs of uni-ovular twins, 126 pairs of bi-ovular twins, and one case of quadruplets showed the following results: 6 pairs of uni-ovular twins had a bilateral distoclusion; one pair had distoclusion on the right side, edge-to-edge bite on the left side; one pair had edge-to-edge occlusion on the left side; in one pair a twin had bilateral distoclusion, the other unilateral distoclusion, and cusp-to-cusp on the other side. Of the bi-ovular twins, only one pair was alike, twelve pairs were dissimilar.

Egon Neustadt.

Editorials

The Hollywood Meeting

AN ANNOUNCEMENT of special interest is the fact that the American Association of Orthodontists will meet in Hollywood, California, at the Roosevelt Hotel, July 11-14; for the first time the Association will hold its annual meeting in America's most colorful city.

The plan, as it is outlined, is to present a distinctive and outstanding program, somewhat apart from the general trend of programs presented at previous meetings of the organization during the last decade. An attempt will be made to focus the program to the point and keyed to the direct problem in hand. For instance, some of the subjects which will be presented are as follows: The place of chrome alloy in modern orthodontics, growth deficiencies in the oral structures, the relation of bodily growth to the orthodontic problem, myofunctional therapy, and a number of other timely subjects of vital interest to orthodontists.

There will be four separate clinic groups which will be witnessed by the entire membership, as well as an unusually large number of general clinics. It is thought that the program will be one of the most valuable, from a practical standpoint, to the average practitioner that has ever been held in the history of the organization. Under the leadership of Dr. McCoy, the theme song for the meeting seems to be adapted to meet the active, everyday problems in orthodontic practice. It is reported from Hollywood that the meeting will be held in air-conditioned rooms, and this will, no doubt, add much to the physical comfort of those in attendance.

The Pacific Coast region, long regarded as orthodontically progressive, for the first time now entertains the newly formed American Association of Orthodontists. Orthodontists are assured of a unique and progressive meeting, to be held in the film capital of the world. Those attending may travel over paved roads, all the way, from almost any part of the United States and Canada, or travel in some of the finest deluxe streamlined trains in the world.

Hollywood will no doubt register one of the largest attendance records ever enjoyed by the A. S. of O. under its new name, the American Association of Orthodontists.

H. C. P.

The New Army Dental Bill

MANY of those who have contributed much to the advancement of dentistry as a profession feel that the future progress of the specialty will be more closely linked with scientific medicine than it has been in the past. This seems to be the trend of the times, and for many years the American Dental Association

has sought to bring about this close relationship between the two professions without losing the identity and individuality of the dental group.

The recent army legislation providing for an increase in the Dental Corps, also the appointment of a dental officer as Assistant to the Surgeon General, marks one of the most important stages in the progress of dentistry in its first century as a profession. Reduced to its lowest common denominator, this means that the United States Army has recognized dentistry to be a specialty of medicine and that it is highly important as a health service. Many problems in the field of medicine need this essential unity of both professions for their solution.

Brigadier General Leigh C. Fairbank

Therefore, a closer unity between the two within the Medical Department of the Army indicates the possibility of mutual benefit for both in the future.

Dentistry can take great pride in the dignified and cooperative spirit shown by Dr. George B. Winter, Dr. Leroy M. S. Miner, and Dr. C. Willard Camalier during their administrations in the American Dental Association, for they have been influential in establishing the most cordial relations with the Surgeon General. Always interested in developments advantageous to the Medical Department, the Surgeon General, Major General Charles R. Reynolds, sought for new legislation to improve the dental service of the Army immediately upon his appointment as the Surgeon General, and each year was successful. Legislation affecting the Medical Department in any way must necessarily be in accord with the policy of the Surgeon General, and it is most significant that General Reynolds desired a more adequate dental service and a future development of

dentistry in keeping with the progress of the Medical Department. In a conference between General Reynolds and several officers of the American Dental Association, the president of the Association found the Surgeon General eager to cement the relations between the two professions and to provide in a much better way for the improvements in the Dental Corps. Contrary to information given out, upon the passage of the dental bill on January 29, 1938, the Collins Bill was never reported out of the Military Affairs Committee of the House. The Bill which became a law on January 29, 1938, was written by the Surgeon General with the full knowledge of several of the officers of the American Dental Association. It had the approval of the War Department. It differed from the Collins Bill in some respects, but these changes were much to the benefit of dentistry and to its future destiny.

Important in reviewing the activities of the last three years in securing the passage of this legislation is the fact that advanced dental opinion and broad considerations of medical progress seem to create a unity which definitely points to mutual benefit. In General Reynolds' broad policy dentistry is given a useful place in the field of medicine; the road is open and progress thereby assured in conjunction with medicine. Those whose devotion and ideals are for the good of our profession will recognize the outstanding service rendered dentistry by General Reynolds.

It is gratifying to dentists, and particularly to orthodontists, that Leigh C. Fairbank, D.D.S., was selected as the first brigadier general of the Dental Corps of the U. S. Army, by the President of the United States, on February 25, 1938. The nomination was confirmed by the Senate on March 4th, and the appointee took the oath of office on March 11th.

Brigadier General Fairbank is a protégé of the late Martin Dewey. He is a member of the American Association of Orthodontists and has been certified by the American Board of Orthodontia. He has been in charge of the orthodontic clinic at the General Dispensary in Washington, D. C., for the last three years. General Fairbank has availed himself of the advantages of many post-graduate courses in the various departments of dentistry. He is a Fellow of the International College of Dentists. Under his leadership all will watch with confidence the progress of the newly created relation within the Medical Department as a far-reaching influence on dental practice as a whole. This no doubt foreshadows great advance for the dental service of the United States Army.

Not only has another milestone in the steady progress of dentistry been passed in this legislation, but by the appointment of General Fairbank for this important task an individual is placed in charge who has devoted much of his career to the practice of orthodontics in various army posts. This specialty will feel reflected recognition as an important department of health service in the naming of a dentist who is a highly trained orthodontist to this important post.

H. C. P.

What Every Orthodontist Knows

OF significance is the editorial which appeared in the March, 1938, issue of *Dental Digest* in which Editor Ryan quotes from a letter sent to him by a woman, aged 36 years, under the nom de plume "An Ugly Duckling." She states that she is afflicted with a deep seated inferiority complex as the result of suffering from so-called buckteeth. In fact, so serious has been this affliction, according to her letter, that there have been times when she has contemplated suicide. Her failure to marry she blames on the unsightliness of her mouth, and she wishes to know whether there is any possibility of having the teeth corrected at her age, explaining that she would literally mortgage her life to have that part of her anatomy remade. The editor comments that this individual could have been saved much mental suffering if in her childhood the matter of correction had been placed in competent hands, and that by all means conditions of this kind should always be corrected in order to spare the individual the anguish of neuroses and the unhappy hours which these malformations bring.

It is further pointed out in the editorial that orthodontists have still far to go in order to make their services available; in other words, "the theme song" is that the orthodontic field has not been sufficiently expanded so far as benefit to all the people is concerned and to the wide dimensions that it should assume in health service. The closing paragraph poses the question: "Might not some orthodontic societies organize a treatment-planning and consulting service to aid the general practitioner in treating advantageously the orthodontic patients that he meets?" In districts where no orthodontist is available, it states that a treatment-planning and consultant service for general practitioners, under competent orthodontists, would be more advantageous to the public than the lack of treatment or even the type of service that children in small communities now receive.

There is a note of both sincerity and pathos in the "Ugly Duckling" letter referred to. It is recognized in medicine and in psychology that nervous and emotional instability are contributing causes of many disorders, including neurasthenia, heart trouble, and others. Such conditions as these are often accompanied by vasomotor disturbances, such as blushing and cold hands and feet, and it is therefore easy to understand that a bad case of Class II, Division 1 malocclusion—particularly in a young girl in her teens—might be responsible for far graver consequences in health and personality development than the single factor of unsightliness of mouth and teeth; therefore it might in some cases be a major health problem.

During its brief career the practice of orthodontics has made outstanding strides toward widening the benefits of its service. For instance, in 1912 the state of Texas enjoyed the services of one man who announced that his practice consisted of orthodontics exclusively. In geographical area, his practice ranged from Mexico, D. F., on the south to the Texas border on the north, something like a radius of 2,000 miles. Today, twenty-six years later, the *Orthodontic Directory of the World* lists forty-five men in the state of Texas who claim to

devote either all or the bulk of their time to the practice of this specialty. This illustration reflects a cross section of what has happened elsewhere in the United States of America toward extending orthodontic service. Upon casual observation it would seem that this is a rapid rise for a specialty that has pulled itself up largely by its own bootstraps, with very little formal support from dental educational institutions. The specialty of orthodontics is largely self-made and is continually increasing its efforts, within its own organization and individually, to spread the benefits of its services to wider and wider brackets of children. This requires time and work, because good orthodontists cannot be trained overnight, and good training like playing the piano requires much experience in order to be effective.

For several reasons specialists in years past, as a group at least, have been wary of the so-called supplemental type of treatment, that is, treatment by the orthodontist conducted in conjunction with the patient's own dentist. Many believe that the average general practitioner is insufficiently experienced in the subject to be of practical service in this arrangement other than to stand by, as it were, in case of emergency, such as breakage of appliances or other unforeseen hazard. In the past the percentage of unsatisfactory results and grief experienced by many men who have tried this type of treatment in conjunction with the home dentist has been high in casualties; accordingly one or two failures have usually been sufficient for a complete loss of enthusiasm over further experiment on the part of all parties involved in the attempted correction.

Notwithstanding past history and performance, much progress is now being made in cooperative treatment. Some very creditable results have been noted in cases in which the orthodontist completed the diagnosis; designed and fitted the appliance to place, direct in the patient's mouth; and provided instructions to be followed by the patient's regular dentist. Under this treatment, the patient returns to the orthodontist for periodic visits at prolonged intervals at such times as necessary.

"Where there is a will there is a way" is an old but appropriate adage. Some supplemental treatment (differing somewhat from the plan suggested by Dr. Ryan) is being successfully carried on, but it has enough of the experimental hazard attached to it that it should (and is) being approached with extreme care and caution. Its success depends largely on the amount of careful thought, planning and effort put forth by the orthodontist, as well as upon his will and determination to succeed in the treatment.

So-called mail-order orthodontics, wherein the appliance is made on a model and treatment is directed by a laboratory, is fundamentally unsound and is guesswork—*it never has succeeded and, of course, never will.* On the other hand, Dr. Ryan's suggestion of a "treatment-planning and consultant" service under the auspices of an orthodontic organization would undoubtedly prove unwieldy and confused, and would place more responsibility and grief upon the orthodontic organization than its members would care to assume. The fact remains, however, that orthodontists are unanimously in favor of extending orthodontic services to the widest brackets of childhood possible, consistent with and within the bounds of the possibilities of successful treatment. What are the

best ways and means to bring this about? A committee of the American Association of Orthodontists is now studying this very subject. Theoretically, there are many plans conceivable for the planning of treatment by the expert to be carried out by the patient's dentist, but the only thing wrong with almost all of them is that the orthodontist hesitates to experiment because he does not care to risk his "batting average" of successful cases by their being partly in another operator's hands—that is the traditional Ethiopian in the woodpile.

Supplemental treatment of cases by the specialist in conjunction with the dentist is no doubt an approach to extending orthodontic service more widely. Under present circumstances and conditions, however, in order to eliminate the speculative element of failure in such procedure, the orthodontist should be willing to check and double check from the beginning of treatment to and including the hazardous "period of relapse." In spite of all wishful thinking for an expansive orthodontic program, the experienced operator will work out the supplemental treatment by a "step-by-step" process and with precision and caution; otherwise the casualty list becomes too high to be of service to the public or of satisfaction to the operator.

H. C. P.

In Memoriam

Harry C. Johnson

1902-1938

Dr. Harry C. Johnson, who practiced orthodontics exclusively for many years in Evansville, Indiana, passed away suddenly on March 17. He had been in poor health for the past two years, suffering from arthritis, which made it difficult for him to carry on his work.

Dr. Johnson was born January 4, 1902, at Waverly, Kentucky. He was graduated from St. Joseph's College in Bardstown, Kentucky, June 16, 1920, after having completed his high school course. He matriculated for the study of dentistry at St. Louis University and was graduated from there on June 7, 1924. In college he was an excellent student, a thorough gentleman, endowed with a high degree of the spirit of tolerance.* His classmates also reported him to be a friendly person who took part in all university activities. He was a member of the R.O.T.C. and received a commission of first lieutenant in the United States Army Reserve Corps. He was a member of Delta Sigma Delta dental fraternity.

Dr. Johnson spent a number of months in Louisville under the tutelage of his brother, Dr. Joseph E. Johnson, orthodontist, of that city and began the practice of orthodontics as a specialty in Evansville, Indiana, in October, 1924.

Dr. Johnson married Louise Virginia Andres, of Evansville, November 17, 1927; and some time following her death, he married Juliann Schuler on September 30, 1936. Dr. Johnson leaves two children, Jean Louise and Janet Mary; also a sister and six brothers.

Harry C. Johnson was a wholesome, beloved, and highly respected individual; he carried on a successful orthodontic practice in Evansville for a number of years and was held in the highest regard by the dental profession in Indiana and by all who knew him. Orthodontists will recall him as a genial, affable person, progressive, alert, and a real asset to his profession.

*The editor is indebted to Dr. Ernest W. Clegg of St. Louis, Mo., a classmate of Dr. Harry C. Johnson's at St. Louis University, for some of the interesting side lights of his personality.

News and Notes

The 1938 Meeting of the American Association of Orthodontists

The program and the sequence of events related to its various activities have been completed so that your officers can now give you a rather definite picture of the Los Angeles meeting.

As previously announced, the official headquarters and the seat of most of the activities will be the Hollywood Roosevelt Hotel at 7000 Hollywood Boulevard. It is located within the

The Eighteenth Green of the Bel-Air Country Club

center of one of the city's most interesting metropolitan districts, and our members and guests will find much to entertain them outside of program hours. After all, there is but one Hollywood.

The wives and other members of the family have been provided for with a series of events which will begin Monday evening, July 11, with attendance at some of the outstanding national radio broadcasts. This will be followed Tuesday with a luncheon and style show at America's most unique store "Bullock's—Wilshire." In the evening of this same day will be held the President's Reception, in the Patio of the hotel, with California hospitality in force. Later will follow the banquet and entertainment in the presentation of "A Night in Hollywood." On Wednesday a reception will be held at Max Factor's Make-Up Studio,

where the famous make-up artist will demonstrate the wonders of his profession. That evening, a theater party will be given the ladies at Grauman's Chinese Theatre, which has played such an outstanding part in introducing premiers of the stage and screen. On Thursday afternoon the ladies will be taken through an inspection of the new Columbia Broadcasting Studio, where the intricacies and mysteries of the broadcasts will be explained. In the evening, as a final tribute to their presence, they will be invited to attend the meeting of the First District Dental Society of Los Angeles, and hear Dr. Leuman M. Waugh lecture and show his motion picture in color, depicting his experiences in the Bering Sea while investigating the teeth of the Eskimo.

From the foregoing, it will be quite apparent that if plans are to be made efficiently, the members should, as soon as their questionnaires arrive, make their reservations promptly. This applies not only to the women guests, but to the golf tournament and stag dinner, the banquet, and any other events where attendance must be carefully computed. Hotel reservations must be made directly with the hotel.

The traditional golf tournament will be held this year at the Bel-Air Country Club, which is acclaimed the most beautiful golf course in Southern California. There will be 36 to 18 hole play, and there will be prizes for both rounds. These will be awarded at the stag dinner, Monday evening.

During the week prior to the meeting, the American Board of Orthodontia will meet to consider the applications of those who are complying with the requirements for certification by the Board. Their sessions will also be held at the Hollywood Roosevelt Hotel. Those who wish to take advantage of this opportunity should communicate with the Secretary, Dr. Charles R. Baker, 636 Church Street, Evanston, Ill.

A representative group of commercial exhibits will be staged by those manufacturers and dealers who serve orthodontists. These exhibits will have real educational value, and members and guests will find it to their advantage to visit them frequently during the meeting.

Your officers hope that after reading the sequence of events which follows, and which accurately portrays the program, you will come to California fully prepared to increase your efficiency and enthusiasm for the practice of orthodontics.

Fraternally yours,

JAMES D. MCCOY, President.

Program

MONDAY, JULY 11

8:30 A.M.	Golf tournament. Those to participate will gather in the lobby of the hotel. Special busses will leave at 8:30 A.M., and carry them to the Bel-Air Country Club. Reservations essential.
9:00 A.M. to 5:00 P.M.	Registration. Mezzanine floor—Hollywood Roosevelt Hotel.
10:00 A.M. to 12:00 M.	Meeting of the Board of Directors. Mezzanine floor.
12:15 P.M.	Informal group lunches for those remaining at Hotel Headquarters. In main dining room or "Cinegrill."
2:00 P.M. to 4:00 P.M.	Meeting of the Board of Directors. Mezzanine floor.
2:00 P.M. to 5:00 P.M.	Sightseeing trips for those who wish to visit the neighboring beaches, parks, suburbs, and museums. Automobiles for charter for those desiring them will be available at the hotel. Complete information at Entertainment Committee Desk—main lobby.

2:00 P.M. to 5:00 P.M.	Visit commercial exhibits. Mezzanine floor.
5:00 P.M.	Special busses return from Bel-Air Country Club with those who have taken part in the golf tournament.
7:00 P.M.	Golf dinner (informal—stag). Blossom Room, Hollywood Roosevelt Hotel. Reservations essential: tickets $2.00 per person.

TUESDAY, JULY 12

Executive session:

9:00 A.M.	Report of Board of Censors. Report of Secretary-Treasurer. Report of Program Committee. Special announcements.
9:30 A.M.	Address of welcome. Dr. R. B. von KleinSmid, President, University of Southern California, Los Angeles. Response. William A. Murray, Evanston, Ill.
10:00 A.M.	President's address. James David McCoy, Los Angeles.
10:30 A.M.	Paper: "The Evolution, Development and Application of Myofunctional Therapy in Orthodontics." Alfred Paul Rogers, Boston.
11:30 A.M.	Paper: "When Is the Frenum Labium a Problem in Orthodontics?" Harry E. Kelsey, Baltimore.
12:00 M.	Announcements.
12:15 to 2:00 P.M.	Informal group luncheons. Main dining room. Table chairmen will be representatives of constituent societies. Choose your own table. On Tuesday these will be from: The Pacific Coast Society of Orthodontists, The Central Society of Orthodontics, and The New York Society of Orthodontists.
2:00 P.M.	Paper: "The Place of the Lingual Arch in Orthodontic Therapy." Oren A. Oliver, Nashville.
2:45 P.M.	Paper: "Prognosis of Orthodontic Therapy: Evaluation of Routine Dentomedical Examinations to Determine Good and Poor Risks." Herman Becks, San Francisco.
3:30 P.M.	Paper: "The Control of Inflammatory Conditions of the Oral Mucosa During Orthodontic Treatment." Arthur W. Lufkin, Los Angeles.
4:00 P.M.	Executive session: Report of the Socio-Economic and Legislation Committees. T. W. Sorrels, Chairman, Oklahoma City. Report of the Public Relations Committee. Homer B. Robison, Chairman, Hutchinson, Kan.

Report of Necrology Committee.
Oscar Carrabine, Chairman, New York City.
Report of the Ad Interim Committee,
Report of the Board of Directors.

5:30 to 7:00 P.M. — President's reception (informal), members, guests, and ladies.
Patio, Hollywood Roosevelt Hotel.
Music. Entertainment. Refreshments.

7:15 P.M. — Banquet and entertainment (informal). Blossom Room. Presenting "A Night in Hollywood." (Reservations essential.)

WEDNESDAY, JULY 13

9:30 A.M. — Paper: "A Preliminary Study of Orthodontic Results as Revealed by Cephalometric Records."
H. B. Higley, Iowa City.

10:15 A.M. — Paper: "Principles and Obligations of Orthodontic Education."
B. E. Lischer, St. Louis.

10:45 A.M. — Paper: "Wolff's Law: The Common Ground of Orthopedics and Orthodontics."
John C. Wilson, M.D., President, American Academy of Orthopedic Surgeons, Los Angeles.

11:15 A.M. — Paper: "Fundamental Factors in Bodily Growth and Their Relation to the Orthodontic Problem."
Joseph Pollia, M.D., Los Angeles.

12:00 M. — Announcements.

12:15 to 2:00 P.M. — Informal group luncheons. Main Dining Room—Table chairmen from:
The Southern Society of Orthodontists.
The Rocky Mountain Society of Orthodontists.

12:15 P.M. — Past president's luncheon. Private dining room.

2:00 P.M. — Paper: "Naming Dental and Oral Anomalies."
George R. Moore, Ann Arbor, Mich.

2:45 P.M. — Case Report: "Erupting an Impacted and Encysted Cuspid."
M. R. Chipman, Spokane, Wash.

3:00 P.M. — Paper: "The Place of Chrome Alloy in Modern Orthodontics."
Brooks Bell, Dallas, Texas. Discussed by Archie B. Brusse, Denver, and George H. Herbert, St. Louis.

4:00 P.M. — Executive session:
Report of the Committee to report on the President's Address.
Report of the Inter-Relations Committee.
W. E. Flesher, Chairman, Oklahoma City.
Report of the Nomenclature Committee.
Geo. W. Moore, Chairman, Ann Arbor, Mich.
Report of the Relief Committee.
Harry C. Metz, Pittsburgh.
Report of Constitution and By-Laws Committee.
Frank M. Casto, Chairman, LaJolla.
Report of the American Board of Orthodontia.
Charles R. Baker, Evanston, Ill.
Reorganization Problems.
Nomination of officers for 1939-1940.

Special Clinics—Mezzanine Floor. (Each clinic to be given four times to rotating audiences.)

8:00 to 10:30 P.M.

(1) "Conveying Orthodontic Information to the Dentist and the Layman."
Paul G. Spencer, Waco, Texas.
Nye White Goodman, Los Angeles.

(2) "The Welding of Chrome Alloy."
(1) The Care of Welding Electrodes.
(2) Welding Attachments to Molar Bands.
(3) The Making of Cuspid and Bicuspid Bands.
(4) The Making of Incisor Bands.
(5) Welding Attachments to Incisor Bands.
(6) The Welding of Auxiliaries to Arch Wires.
J. Lyndon Carman, Denver.
K. E. Taylor, Denver.
G. H. Siersma, Denver.
Mark Perrin, Topeka, Kan.
George Herbert, St. Louis.
Brooks Bell, Dallas, Texas.
W. B. Stevenson, Amarillo, Texas.

(3) "The Fabrication of the Removable Lingual Arch Wire and Its Auxiliaries."
Oren A. Oliver, Nashville.
Claude R. Wood, Knoxville.
Russell E. Irish, Pittsburgh.

(4) "Aids in Orthodontic Diagnosis."*
(1) Gnathostatic Denture Reproductions.
Harvey A. Stryker, San Francisco.
Fred Wolfsohn, San Francisco.
(2) Photostatic Facial Reproductions.
Will G. Sheffer, San Jose, Calif.
(3) Roentgenographic Records.
William F. Walsh, Stockton, Calif.
(4) Denture Graphs.
Earl F. Lussier, San Francisco.

THURSDAY, JULY 14

9:15 A.M. Paper: "Nutritional Corrections as an Aid in Overcoming Growth Defects in the Oral Structures."
Nina Simmonds, Ph.D., San Francisco.

10:00 A.M. Paper: "A Plea for Simplicity in Orthodontic Mechanism."
Franklin A. Squires, White Plains, N. Y.

10:30 A.M. Symposium: "Why Do We Have Orthodontic Failures?"
George A. Barker, Seattle.
J. A. Burrill, Chicago.
Leuman M. Waugh, New York.

*The members of this clinic will demonstrate a standardized technique utilizing charts, lantern slides, motion pictures, modern instruments and equipment, and other devices to show the various steps and common errors in orthodontic diagnostic procedure.

11:30 A.M. Conferring of the Albert H. Ketcham Memorial Award by the American Board of Orthodontia.

Frank M. Casto, President, LaJolla, Calif.
B. Frank Gray, Vice President, San Francisco.
Charles R. Baker, Secretary, Evanston, Ill.
B. G. deVries, Treasurer, Minneapolis.
Harry E. Kelsey, Baltimore.
William E. Flesher, Oklahoma City.
Frederick T. Murlless, Jr., Hartford, Conn.

12:00 M. Announcements.

12:15 to 1:30 P.M. Informal group luncheons. Main dining room. Table chairmen from:

The Southwestern Society of Orthodontists.
The Great Lakes Association of Orthodontists.

1:30 to 4:00 P.M. General clinics.

A Mechanical Device for Accurately Reproducing the Positions of Half Round Tubes From the Mouth to the Laboratory Without Taking an Impression for the Purpose of Repairing and Remaking Lingual Arches.

E. B. Arnold, Houston, Texas.

Appliance Used in Correcting Unilateral Crossbite of Maxillary First Molar.

H. B. Bolt, Enid, Oklahoma.

The Application of the Principles of Functional Occlusion to Orthodontic Treatment.

George C. Chuck, Long Beach, Calif.

Self-Corrected Cases of Malocclusion.

Joseph T. Cohen, Minneapolis.

Appliances for the Control of Posterior Units.

C. F. Stenson Dillon, Hollywood.

Identical Malocclusion Existing in Identical Twins.

Arlo M. Dunn, Omaha, Neb.

Maxillary and Mandibular Retention. Every Case a New Problem.

Walter F. Furie, Long Beach, Calif.

Hawley Retains, Simplified Construction.

Paul Hoffman, Washington, D. C.

Malocclusion. The Result of Extraction.

Willis H. Grinnell, Boston.

A Correlation of Ideas and Orthodontic Appliances.

A. F. Jackson, Philadelphia.

Chrome Alloy Orthodontic Appliances.

J. M. Jones, Wichita, Kan.

Appliances for Depressing the Anterior Teeth in Either the Maxilla or the Mandible, or Both; Elongating or Elevating the Molars and Bicuspids. Especially Useful in Treatment of Overbite Cases of Malocclusion.

Howard D. Keeler, Des Moines, Iowa.

The Effect of Pernicious Tongue Habits, Recorded by Motion Pictures.

Herbert V. Muehnic, Los Angeles.

An Appliance for Unit Expansion of the Deciduous Arch and Alignment of the Incisors.

Dallas R. McCauley, Los Angeles.

A Simplified Treatment of Mixed Dentition Cases by Extraction of Mandibular Deciduous Cuspids at Beginning of Treatment.

Hays N. Nance, Los Angeles.

A Double Open-Tube Lingual Attachment.

J. E. Richmond, Eugene, Oregon.

Educational Photographic Exhibit.

L. R. Sattler, Los Angeles.

Photography in Orthodontics.

Will G. Sheffer, San Jose, Calif.

Survey of Growth and Development Without Orthodontic Interference.

Edward I. Silver, Boston.

Simplified Appliance for Early or Late Treatment.

W. J. Speers, Boston.

Unique Method of Treating Anterior and Posterior Malposition of Molars, Premolars and Cuspids by Group Movement With Sectional Cribs and Elastics.

T. Wallace Sorrels, Oklahoma City.

Welding Chrome Alloy Orthodontic Material. Turret Hand Spot Welder and Materials. Rocky Mountain Welder and Materials.

W. B. Stevenson, Amarillo, Texas.

Use of the Modified Bonwill Method for Arch Form Determination to Act as a Guide in Making the Ideal Edgewise Arch.

Irwin F. Steuer, Cleveland.

Efficient Appliances.

George L. Turner, Los Angeles.

The Orthodontist's Laboratory "Machine Shop" for Attachment Construction.

M. Alden Weingart, New York City.

GROUP CLINIC—UNIVERSITY OF CALIFORNIA STAFF

A Universal Complete Scientific Method of Orthodontic Record Keeping.

Earl F. Lussier, Chairman, San Francisco.

Preliminary Records and Permanent Records.

Ray Lussier, San Francisco.

Gnathostatic Records.

William F. Walsh, Stockton, Calif.

Photostatic Records.

Fred Shubert, San Francisco.

Radiographic Records.

Gordon Fitsgerald, San Francisco.

Dietary Records.

Nina Simmonds, San Francisco.

Physical Records.

Herman Becks, San Francisco.

Financial Records—Index.

Marion Heckman (Miss), San Francisco.

EXHIBIT OF TREATED CASES

As a special feature of the meeting, an effort is being made to put on a comprehensive exhibit of treated cases. To this end, individuals and groups who are known to advocate and use certain definite types of appliances have been invited to contribute one hundred cases each, these to be of the various types encountered in daily practice. In this way the effectiveness of the mechanism advocated, as well as the skill of the clinicians, can be demonstrated.

At the time the program goes to press the following had offered their cooperation. At the meeting we are hopeful others will have enlisted. If so, special announcements of their exhibits will be made.

"One Hundred Cases in Which the Edgewise Appliance Was the Orthodontic Mechanism Used in Treatment."

Charles H. Tweed, Tucson, Arizona.

"One Hundred Cases in which the Removable Lingual Arch Wire, Alone or in Combination With the Round Labial Arch Wire, Was the Orthodontic Mechanism Used in Treatment."

Oren A. Oliver, Nashville.
Claude R. Wood, Knoxville.
Russell E. Irish, Pittsburgh.

"One Hundred Cases in Which the Open Tube Appliance Upon the Maxillary Teeth and the Removable Lingual Arch Wire Upon the Mandibular Teeth Were the Orthodontic Mechanisms Used in Treatment."

James David McCoy, Los Angeles.
John Rush McCoy, Los Angeles.

"One Hundred Cases in Which the Half-Round Pin and Tube Appliance Was the Orthodontic Mechanism Used in Treatment."

Glenn Young, New York City (and Group).

4:00 P.M. Clinics close.

4:15 P.M. Business session:

Report of the Research Committee
George W. Moore, Chairman, Ann Arbor, Mich.

Report of the Publication Committee
Brooks Bell, Chairman, Dallas, Texas

Report of the Budget Committee
O. W. White, Chairman, Detroit

Report of the Education Committee
Earl G. Jones, Chairman, Columbus, Ohio

Report of the Librarian
Abram Hoffman, Chicago

Installation of Officers

Conferring Past President's key

Special meeting of the First District Dental Society of Los Angeles, honoring the members of the American Association of Orthodontists.

8:00 P.M. The Blossom Room, Hollywood Roosevelt Hotel

The essayist of the evening will be Leuman M. Waugh, New York, N. Y., Professor of Dentistry, Director of the Orthodontic Clinic, Dental School, Columbia University; Dental Director (R) U. S. Public Health Service; Consultant Dentist, U. S. Indian Service.

SUBJECT: "DEDUCTIONS FROM A SURVEY OF THE FOOD AND DENTITION OF THE AMERICAN ESKIMO"*

The object of the essayist will be to present findings that will have direct clinical application in the solution of the vexed problem of:

(a) Dental caries—prevention and control;

(b) Periodontoclasia—local effects of rugged chewing and excessive depositions of calculus;

(c) Jaw and face growth—the influence of mastication.

(Illustrated with motion and still photography in color.)

European Orthodontological Society

The annual meeting of the Society will be held in London July 14 and 15 under the presidency of Dr. Harold Chapman.

American Dental Association

The eightieth annual session of the American Dental Association will be held in St. Louis, Mo., October 24-28.

American Dental Assistants Association

The fourteenth annual session of the American Dental Assistants Association will be held at St. Louis, October 24-28, with headquarters at the DeSoto Hotel. For further informations, address

LUCILE S. HODGE, Secretary,
401 Medical Arts Bldg.,
Knoxville, Tenn.

American Dental Hygienists' Association

The American Dental Hygienists' Association will meet October 24-28 at St. Louis.

DAISY M. BELL, Secretary,
974 Amherst Street,
Buffalo, N. Y.

Report of the Eighteenth Annual Meeting of the Southwestern Society of Orthodontists

The eighteenth annual meeting of the Southwestern Society of Orthodontists was held March 6, 7, and 8, in Dallas, Texas, with about fifty members and fifty guests present.

The program, headed by Dr. Oren A. Oliver and Dr. Hermann T. Becks, proved to be one of the finest the Southwestern Society has ever had; with the twenty-five clinics far above the usual clinical demonstration, and splendidly presented.

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*Data for this survey have been collected during the past fifteen years under the joint sponsorship and support of Columbia University, the United States Public Health Service, U.S. Office of Indian Affairs, and the United States Coast Guard.

New members received during the session were: Drs. C. T. Roland, San Antonio, Texas; J. Victor Benton, Wichita, Kansas; John A. Talbot, Pine Bluff, Ark.; and C. W. Koch, Little Rock, Ark.

Officers elected for next year are as follows:

President: Frank H. Harrison, Wichita Falls, Texas.
President-elect: J. H. Weaver, Houston, Texas.
Secretary-treasurer: R. E. Olson, Wichita, Kansas.

Board of Censors:

G. C. Turner, Lubbock, Texas.
E. F. Woodring, Tulsa, Okla.
H. D. Harper, Shreveport, La.

The golf tournament had its usual fine turnout, with E. Forris Woodring turning in a neat 79, for honors.

Credit for this successful meeting must go to the hosts: Drs. A. B. Conly, Oscar Busby, Brooks Bell, and L. B. Williams; and their genial wives.

Postgraduate Courses at the School of Dentistry, University of Pennsylvania

As a result of collaboration with a committee of the alumni, the faculty of the School of Dentistry of the University of Pennsylvania announces that two postgraduate courses, in (1) dental prosthesis and (2) oral surgery, exodontia and anesthesia, are being conducted at the Evans Institute, Fortieth and Spruce Streets, Philadelphia, each to extend from May 23 to June 8. This period immediately precedes the Alumni Day activities of the University. In addition to the course of didactic and clinical instruction by regular members of the teaching staff and others, lectures by well-known specialists several evenings during the period are open to the profession.

Third Summer Seminar

The Third Summer Seminar for the advanced study of orthodontics will be held in Denver, June 30 to July 7. The Summer Seminar was organized in 1936 by a group of orthodontists, and it has been their desire that it be continued as an annual event, as a contribution to orthodontic education. This year there will be lectures and demonstrations given by Dr. Hermann Becks, Dr. Clinton C. Howard, Dr. A. LeRoy Johnson, Dr. Allan G. Brodie, Dr. Oren A. Oliver, and others.

Argentina Orthodontic Society

The Argentina Orthodontic Society will hold the First Orthodontic Convention of the Argentine Republic July 1-15, in Buenos Aires.

The Society will be pleased on this occasion to welcome the attendance of all those interested in the subject of orthodontics, and it solicits the cooperation of written papers, clinics, and practical demonstrations in subjects pertaining to the science and art of the practice of orthodontics.

The president of this new organization is Dr. Juan Ubaldo Carrea, and the secretary is Dr. Armando E. Monti. Address: 1346 Jose E. Uriburu, Buenos Aires, Argentina.

Notes of Interest

Dr. P. R. Ashplant announces the association of Dr. M. Peter Breidt in the exclusive practice of orthodontics. Offices at 170 Grand Street, Newburgh, N. Y.

Dr. T. C. Sparks announces the removal of his office to the Medical Arts Building, 1508 Washington Street, Columbia, S. C. Practice limited to orthodontics.